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HOOD RIVER RATE CASE.

The case recently decided by the Railroad Commission of Oregon, fixing rates for the Hood River Gas & Electric Company, and the Hydro Electric Company, involves a number of interesting points, but perhaps none is more worthy of note than the attitude taken by the Commission with respect to early losses incurred through cut-throat competition.

The two companies, now under common control, were involved in fierce competition before coming under the regulative jurisdiction of the state commission. This involved a deficit in revenue through cutting rates, furnishing a certain amount of free service and other discriminatory practices, and also an abnormal expense through the fight to get new business. The Commission refuses to recognize such losses as legitimate expenses of building up the business, but does recognize the principle of capitalization of expenses properly incurred in developing the business.

Such losses as those above mentioned, however, are not regarded as building up the business, or helping to put the utility in a condition to serve the consumers. They are held to contribute nothing toward building up a going concern, and are not to be foisted upon the customers of the utility, but must be borne by the owners of the utility, and it happens in this case that the competing utility which entered the field already occupied is the one chiefly involved. Now that common ownership has been established, however, that is a matter of little concern with respect to the fixing of future rates.

The conditions brought out as existing in Hood River illustrate once again the futility of attempting to solve the problem of utility service by establishing two or more independent competing companies. The results are not satisfactory to the consumers, and bankruptcy to one or possibly two companies ensues. If not driven entirely to the wall, the weaker concern is bought out by the stronger, the service is eventually consolidated; nothing has been gained, but much is usually lost.

In the long run better service will be given by a single utility, and the combination of good service with reasonable rates can be effected through the supervision of a regulatory commission in the cases of those utilities having such undiscerning management as to let conditions reach the point where commission interference becomes necessary.

ELECTRICITY IN AGRICULTURE.

Many reports have been given out from time to time indicating an increase in vegetable growths of many kinds due to the stimulation of electric energy in one form or another. Experiments of this nature have been fairly numerous, and while no doubt can be entertained as to the results, there has not always been satisfactory evidence as to the direct cause of the results. Control experiments have not always been carried out in such a way as to satisfy the critical, and doubts have sometimes been expressed as to whether results have been due directly to electric stimulation or to some co-existing condition which has not received proper attention.

The weight of evidence, however, indicates that under the most advantageous conditions electric stimulation has increased crop yields of many kinds. The favorite method of application has been to cause a high-tension discharge to the ground from insulated conductors which have been arranged over the growing plants. It has been observed that a positive discharge gives better results than a negative one, and consequently where alternating current is used it is preferable to either rectify the current or else insert in the circuit an electric valve which will permit discharge only in one direction. Much more experimentation is needed along these lines from a practical and commercial standpoint, for while beneficial results can be secured it is very questionable whether the commercial results are sufficient to justify the necessary expense.

Electric stimulation appears not only to affect vegetation, but to have a similar effect upon living creatures. Experiments carried out in England in connection with chicken raising have indicated that young chicks subjected to an electrified atmosphere for a certain interval each day show not only a greater vitality, so that a lower percentage of mortality is obtained, but also show a much more rapid growth under the same feeding or an equal growth with a more limited diet. Too strong or too frequent application of the electric stimulation was on the other hand found harmful. Such an application of electric stimulation would seem much more susceptible of commercial exploitation than the stimulation of plants.

Certain experimenters have announced somewhat similar increases in the growth of plants from a stimulation by radioactive materials. It has been claimed that the growth of plants and the yield of useful parts, such as seeds or roots, can be remarkably increased in this way. The reliability of such conclusions is, however, somewhat a matter for question in view of the uncertainty of the causes and the unconvincing nature of the control experiments. In a recent issue of *Science*, Messrs. C. G. Hopkins and W. H. Sachs report experiments carried on at the University of Illinois to test this question, and it is notable that in this case no definite beneficial result of the application of radioactive substances to the soil was found. These experiments covered two years and involved a large number of trials. The crops experimented with were corn and soy beans. The amount of radium salt used was varied, applications costing $1, $10 and $100 per acre being used, the idea being to make the experiments a real commercial trial.

While these results were entirely negative, it is to be noted that certain other experimenters have found that the stimulation varies greatly with different plants and that those selected may not have been most susceptible to this form of excitation. While it is well known that radioactive substances continually give off energy, which is usually manifested in the form of heat, no appreciable effect can be expected from any direct temperature elevation. This is easily seen when it is considered that a thousand dollars' worth of radium gives off no more heat in one hundred days than is received from the sun on one square foot of the earth's surface in thirty seconds. The recent announcement that the Bureau of Mines has greatly lessened the cost of production of radium by a new process which has been applied to the carnotite ores of Colorado is not likely to have any effect upon the application of radioactive materials to agriculture. Here again it would seem that even though beneficial results may be obtained under certain circumstances, the cost of applying stimulation is likely to be much larger than the commercial value of any beneficial results which may be obtained.

CHEMICAL REACTIONS IN MAGNETIC FIELDS.

Experiments have been reported from time to time which have indicated that the chemical action taking place in aqueous solutions has been modified by the existence of a magnetic field in the solution. Great difficulty has been experienced, however, in distinguishing between a case of this sort and one in which the action is due to local differences in the concentration of the solution. Departures from the homogeneity of the mass might arise from the differences in the magnetic susceptibility of different substances which might lead to differences in the concentration in the presence of a magnetic field.

Recent experiments indicate, however, that differences in concentration cannot be produced in a mixture by separation of the constituents through magnetic action, but where a new compound is being formed, as at the surface of a solid, the magnetic action may prevent this from diffusing throughout the mass at the same rate which would be observed in the absence of the magnetic field. Consequently, the existence of the field may in some cases produce a change in the chemical result through its effect upon concentration. Thus, if two pieces of iron are immersed in sulphuric acid and one of these pieces is magnetized, a resultant electromotive force may be observed. This has been shown in some work by Rathert to be due to the magnetism of the ferrous sulphate which is formed. Stirring the solution interfered with the results obtained.

It would appear from available experimental data concerning this problem that the only way in which the magnetic field may affect chemical action is

through the physical effects which it may exert and that the same chemical phenomenon would take place if the physical conditions could be reproduced in some other way than by the action of the magnetic field.

GETTING THE MOST FROM THE ELECTRIC VEHICLE.

It has been amply demonstrated that the electric vehicle is well adapted to a large variety of work and that it constitutes the most economical means of transportation in cases where it is fitted for the work which is to be done. It is fully realized by those central stations which have acquired battery-charging load that the electric vehicle represents one of the most profitable developments of the future. The problem for every central station should therefore be to develop the use of electric vehicles in its own territory as rapidly and as fully as possible. It has before it the problem of finding users.

It has been frequently pointed out that the first step for the central stations which desire to encourage the use of electric vehicles is to adopt that means of solving its own transportation problems. If the central station does not set this example, any arguments which it may advance to its customers will have little weight, for actions invariably speak louder than words. If the central station does adopt electric wagons, it should, not only for its own satisfaction, but in order for its demonstration to be convincing to others, get the vehicle which is best adapted to its special requirements. The greatest care is necessary in making a selection in order that the vehicle will show up at its best. In the past this has not always been done, as is emphasized by Mr. George Drake Smith in the discussion presented by him at the convention of the Ohio Electric Light Association last month, and which is given in full on other pages of this issue. Mr. Smith presents a serious indictment against certain unnamed central stations which have not given proper care to their electric vehicles after securing them, and against others which have ordered vehicles for one service and later applied them to a more onerous service which they were not designed to withstand successfully. In consequence there have been a number of cases of dissatisfaction and disappointment with the electric.

The electric vehicle has features which make it especially suited to a number of central-station needs, but to satisfactorily fulfill these the type of machine must be well chosen and it must be properly handled in use and not subjected to abuse. In specifying a type of vehicle which shall be purchased for a given use, it is well also to choose a standard model whenever it is feasible to do so, rather than to require a special design. With a proper analysis of requirements, attention to previous experience of others and to numerous operating data which are now available, the central station should have no difficulty in securing a vehicle which would be perfectly satisfactory.

THE CHARACTER OF ELECTRICAL SERVICE.

Among the more conspicuous features of municipal electrical service in England is the influence which the chief engineer and manager of an undertaking frequently has upon the character which his system bears in both the technical and the public estimation. It is prefectly true that cases might be named of engineers whose chief grievance has been that in their advanced views they have not been able to secure the necessary support of their electrical committee, or else of some important opposing section of the municipal council. Of course, there are cases where those armed with superior authority, whether possessing superior knowledge or intellect or not, have been able to clip the wings of the engineer whose inclination is to fly; but generally he soon can discover the uncongenial and unhealthy nature of the atmosphere and he shakes the dust of the city from his feet. When this has happened the most interesting development has been witnessed when his successor has been appointed and has been given practically a free hand! It has been amusing at times to note how the new man has been allowed to carry out extensions costing hundreds of thousands of dollars which the departed chief knew to be necessary, recommended, and saw turned down. As new brooms sweep clean, so sometimes the new man, because he is new, inspires such confidence to the municipal mind that he is allowed to sweep everything before him.

But there are outstanding examples of undertakings where there is nothing akin to fickleness; where councillors have had minds of most gratifying receptivity, and in consequence because the engineer or manager has been of the strongly progressive type the undertaking under his control has been allowed to make for itself a progressive reputation, and the councillors have taken their share of credit as well. Given reasonably favorable conditions, the character of the "chief" and that of his system have been alike.

In the same way the progressive spirit of the chief manifests itself throughout and not merely in one isolated section of his work. Men of enterprise and foresight, when the power load was just beginning to come along, launched out to meet the situation by motor-hiring arrangements and convenient rate schedules; when the cooking question came to the fore, these men saw the possibilities, and while others were suspicious, skeptical, or lagged behind, they acted enterprisingly; and now that the electric vehicle business is beginning to move in England, they are prominent with their efforts to render available all possible facilities for its encouragement.

The chief who wants to move forward, but finds his councillors as a stone wall before him, is a subject for our sympathy; but in the majority of cases the progressive man leaves a very definite progressive mark upon his undertakings

Chicago Makes Big Plans for Jovian Convention.

The thirteenth convention of the Jovian Order will be held at Chicago, Ill., Wednesday, Thursday and Friday, October 13, 14 and 15. Headquarters will be established at the Hotel Sherman, Randolph and Clark Streets.

There will be a reception to the Past Jupiters' Association on Tuesday evening, October 12, followed by dancing.

The opening session will be held on Wednesday morning, and Wednesday afternoon the Jovians will be the guests at luncheon of the business interests of Chicago, the affair very likely being tendered under the auspices of the Association of Commerce. The afternoon will be devoted to an outing trip, and in the evening there will be an elaborate entertainment.

On Thursday morning there will be a business session, the afternoon being devoted to the degree team competition. The evening will witness the annual rejuvenation, at which it is expected to have the banner class in the record of Jovianism.

Friday morning there will be a business session, and in the afternoon the closing session and the election of the fourteenth congress. The convention will conclude with a banquet on Friday evening.

A big general committee under the chairmanship of Homer E. Niesz, Thirteenth Jupiter, is planning for an enthusiastic reception to the visitors, and details already arranged indicate that the convention will offer extraordinary attractions both in the matter of addresses from leaders in various branches of the industry and in entertainment. Special provision is being made for the comfort and entertainment of the visiting ladies.

Program of Papers for Municipal Electricians.

The following papers have been announced for the convention of the International Association of Municipal Electricians, to be held at Cincinnati, O., August 24 to 27:

"The Advisability of Using Concentric Wiring in This Country," by R. A. Smith, city electrician, Norfolk, Va.

"Fire-Alarm Systems for Industrial Plants," by Albert J. Cross, of the Gamewell Fire Alarm Company, New York.

"The Scope and Present Status of the National Electrical Safety Code," by W. J. Canada, Bureau of Standards, Washington, D. C.

"Practical Cable-Maintenance Methods," with demonstration, by O. F. Tallman, of W. N. Matthews & Brother, St. Louis.

"Storage Batteries for Fire-Alarm Purposes," by representative of the Electric Storage Battery Company, Philadelphia.

"The Work of the Bureau of Standards, including some account of the Co-operation of the Bureau with Municipalities in securing Electrolysis Mitigation and improving Electrical Service and Meter Accuracy," by E. B. Rosa, Bureau of Standards, Washington, D. C.

"Uniform Electrical Standards," by John Price Jackson, commissioner of labor and industry of Pennsylvania.

"The Importance of the Superintendent of Fire and Police Telegraph to his Municipality," by W. H. Flandreau, city electrician, Mt. Vernon, N. Y.

"Police Patrol and Fire-Alarm Records," by Price I. Patton, Electrical Bureau, Philadelphia, Pa.

"Lightning Protective Apparatus for Fire and Police Telegraph Circuits," by L. S. Brach, Newark, N. J.

"The Fallacy of Placing Fire and Police Alarm Wires in Telephone Cables," by C. E. Convers, city electrician, San Antonio, Tex.

"Standards for Fire-Alarm Installations," by F. A. Raymond, of National Board of Fire Underwriters, New York.

Electrochemical Society Meeting.

The fall meeting of the American Electrochemical Society will be held in San Francisco, from Thursday, September 16, to Saturday, September 18. Special transportation facilities have been arranged for by a committee of which J. M. Muir, 239 West Thirty-ninth Street, New York City, is chairman. The regular society train will leave New York on Saturday, September 11, and the special engineers' train on Thursday, September, 9.

At the time of holding the meetings, the American Institute of Mining Engineers and the American Institute of Electrical Engineers will also be in session, and joint meetings have been arranged with these societies for Friday, September 17. During the following week the International Engineering Congress will hold its meetings.

The following papers have been accepted to date and will be presented at the meeting:

W. D. Bancroft, "The Peptonization of Chromium Oxide."

F. M. Fredericksen, "Electrochemical Synthesis of Phenol Hydroxyl Amine."

A. G. Bettes, "Electrolytic Antimony Refining."

C. W. Bennett, Rose and Tinkler, "Electrodeposition of Nickel."

W. D. Bancroft, "Electromotive Forces." (This is a review of the fundamental formulas of electromotive force and amendment of the fundamental Nernst equation, deriving it also from a more general standpoint.)

Wills and Schuyler, "Heat Losses from an Electric Steel Furnace."

W. R. Mott, "Use of the Flame Arc in Paint and Dye Testing."

R. S. Bosworth, "Collection of Radium Emanation and its Application for Therapeutic Use."

F. T. Snyder, "Electric Steel Costs." (An analysis of the cost of making electric steel from cold raw materials on a small scale for foundry use.)

R. S. Wile, "Melting of Ferro-alloys in the Electric Furnace."

L. Addicks, "The Electrolysis of Copper-Sulphate Liquors Using Carbon Anodes." (An extended account of recent experiments in leaching copper ores in Arizona, and the successful use of carbon anodes in electrolyzing sulphate solutions.)

F. R. Pyne, "Solution Stratification as an Aid to the Purification of Electrolytes."

F. M. Sebast, "Electrical Resistance of Copper-Nickel-Chromium Alloys."

J. W. Beckman, "Electrochemical Possibilities on the Pacific Coast." (A discussion of the location and cost of power supply, of raw materials and possible markets for electrochemical products manufactured on the Pacific Coast.)

Other papers will be presented by members of the American Institute of Mining Engineers.

Special arrangements have been made for members to visit mining, metallurgical, hydroelectric and various other engineering operations in California on September 18.

Further Canadian Hydroelectric Development at Niagara Falls.

Some months ago its was announced that the Ontario Hydroelectric Power Commission had nearly exhausted the 100,000 horsepower obtained from the Ontario Power Company at Niagara Falls at a cost of $9 a horsepower, and that it would soon be necessary for the commission to contract for additional power or build its own generating plants at Niagara Falls and the spillways of the new Welland Ship Canal.

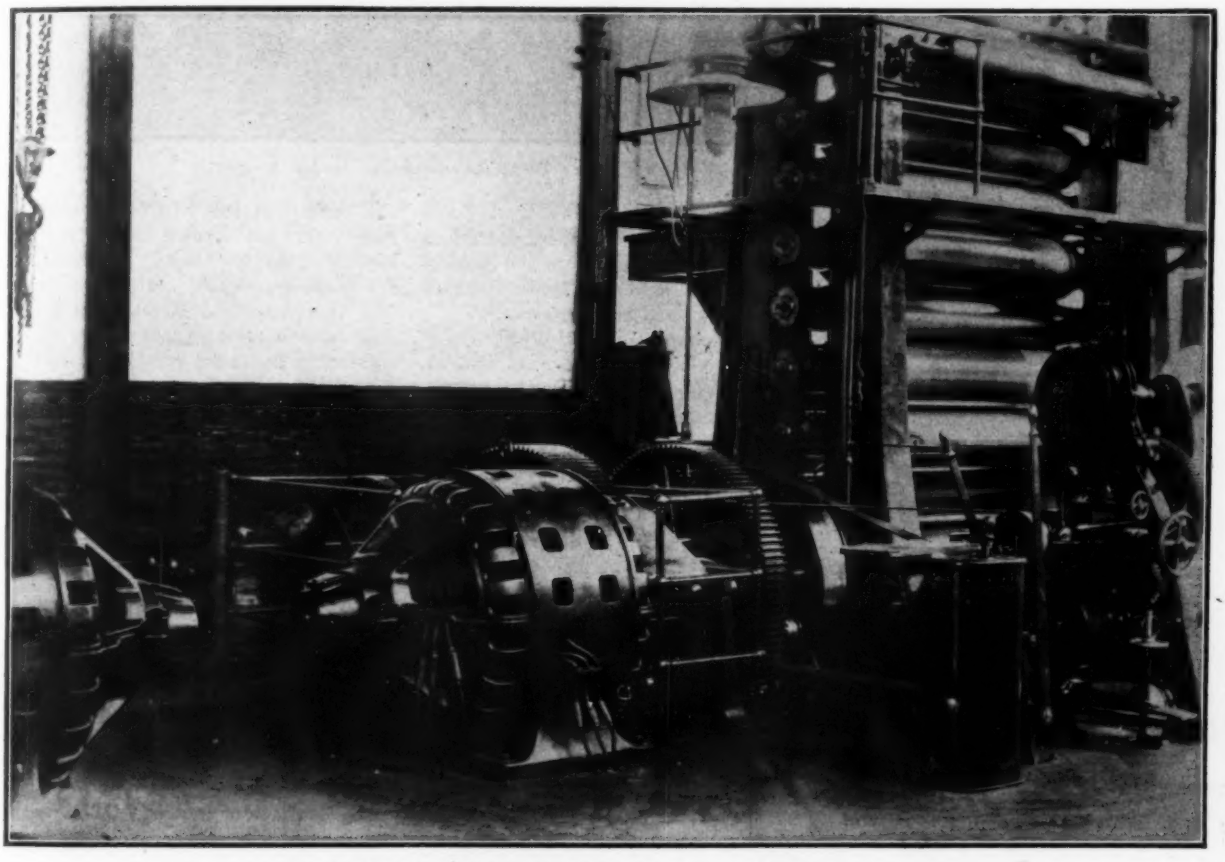
It is now authoritatively announced that the Commission is about to submit to the Ontario Government plans for the development of the remaining 6,600 second-feet of water available at the Falls under the treaty and the additional power obtainable from the spillways of the Welland Canal to the total extent of 250,000 horsepower, of which 100,000 horsepower is to be developed as early as practicable. The entire development proposed would cost some $10,000,000 and require three years for its completion. The work will be financed by the Province of Ontario for the benefit of the municipalities, which will be responsible for the outlay incurred in providing additional hydroelectric power.

Electricity in Manufacture of Wood-Pulp Paper.

This article describes the various processes involved in paper-making, giving recommendations as to the size and type of the motor required. Particular attention is accorded the characteristics and power requirements of super-calenders, used in the manufacture of high-grade paper.

Electric-motor drive has been extensively adopted for the operation of pulp and paper mills in the last decade and it has numerous advantages for this industry aside from the general advantages of safety to employees by the elimination of large belts and shafts, increased production, improving hygienic conditions and general flexibility with ease of control.

Continuity of service and uniform speed are two of the important essentials of the power requirements in the manufacture of paper. When a run of stock is started it must be continuous and any lack of uniformity in speed seriously impairs the product. The starting conditions of pulp and paper machinery are severe and large overloads are frequently encountered. Furthermore certain portions of the paper-making machinery require a variable speed which is admirably met by the variable-speed electric motor without the use of cumbersome mechanical speed-changing devices. The speed of paper machinery must change as the weight and thickness of the product changes and any efficient means of quickly controlling the speed of the machines adds to the rate of production. In some of the departments all of the machines are not used constantly, therefore individual electric motor drive is particularly adapted as the continual losses in long lines of shafting, with numerous belts, is eliminated and any one machine may be operated independently of another.



Motor Driving Calender, West Virginia Pulp and Paper Company.

Roughly the grades of paper and their raw product are divided as follows: Writing and printing papers made from rags, esparto and wood pulp; wrapping papers and paper boards made from wood pulp, hemp, jute, straw and waste paper. The majority of printing paper used in this country is made from wood pulp, of which there are two general divisions, mechanical wood pulp and chemical wood pulp. The former is generally used for the cheaper grades of paper such as used by newspapers. The mechanical pulp undergoes the following processes: First gathering and delivering the logs, then respectively barking, grinding, boiling, screening and pressing. In the chemical process, gathering the logs, chipping, screening, pressing and making the dry pulp liquor are in order.

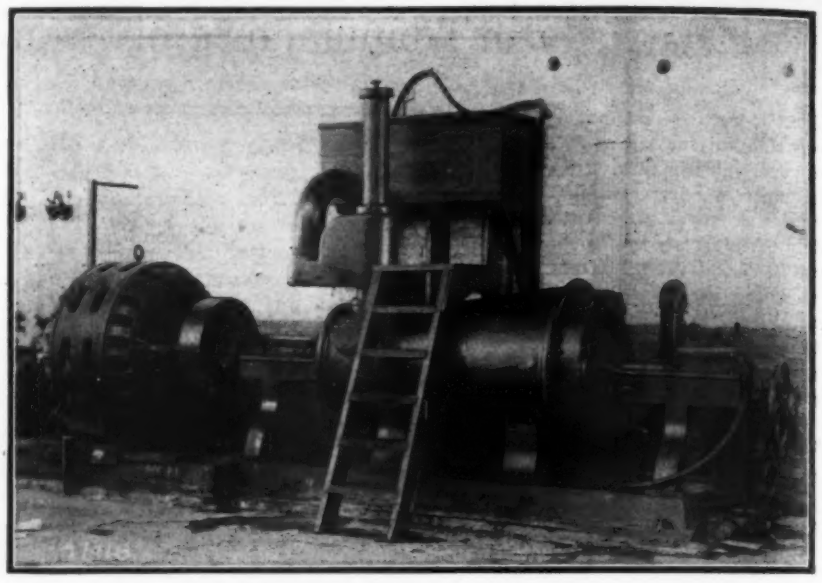
In general, the manufacture of paper involves a number of successive operations, each of which plays an important part in the production of properties required in any particular paper. The general principles underlying these operations are the same, whatever the nature and quality of the raw material or whatever the nature and quality of the finished paper. The variations in detail in certain stages of manufacture are naturally considerable. The stages of manufacture may be classified as follows: The isolation of the paper-making fiber, cellulose, from the raw material; conversion of the cellulose into pulp, or "half-stuff"; beating of the half-stuff; manufacture of the paper from the beaten pulp, and the processes for finishing the paper.

The nature and extent of the process by which the fiber is obtained from the raw material depends partly on the physical and chemical characteristics of the vegetable tissues and partly on the nature of the paper desired. For certain prod-

ucts, such as browns, wrappings, millboards, cardboards and the like, the preliminary treatment is so slight that the prepared fiber differs but little from the raw material, while, on the other hand, for better-class papers, such as those required for magazines, fine printings and machine-finished writings, which are mainly prepared from esparto and wood, the treatment is so severe that the fiber obtained has little in common with the raw material either as to physical structure or chemical composition.

Generally speaking, the methods adopted for the isolation of paper-making fiber aim at the production of a more or less pure cellulose by digestion of the raw material with alkali or acid salts at a fairly high temperature. The alkali process is in practice applied to practically every commercial fiber, but the acid process is at present confined to the manufacture of chemical wood pulp. The cellulose freed from the valueless organic compounds with which it is closely associated in the raw plant has then to undergo conversion into what is termed "half-stuff," a convenient term for pulp when partially prepared. The boiled material, which usually retains its shape and general form even after the severe process of digestion, is mechanically disintegrated into single isolated fibers and in this condition the pulp obtained can be readily bleached.

"Beating" the half-stuff is probably the most important stage in the manufacture of paper, and one in which the quality of the finished article may be varied to almost any extent. For ordinary machine-finished papers, the sizing, loading and coloring of the pulp are effected at the same time and in the same appliances as the beating process. The pulp is finally converted into paper by paper-making machines and the process relating to the finishing of the papers comprises calendering, glazing, cutting, sorting and packing. In addition to these operations of general application there are particular methods of producing specialties, such as art, duplex and other papers.



Motor Direct-Connected to Jordan Engine.

Mechanical Wood Pulp.

Paper-making fiber known as mechanical wood pulp is so called because prepared by purely mechanical methods, in contra-distinction to pulp manufactured by chemical processes. Trees are cut down in the winter time by gangs of men, and piled up on the frozen rivers until spring when they gradually find their way to the mill. Other means of transportation of the logs can, of course, be employed. The logs as brought into the pulp mill are usually 12, 14 or 16 feet long. They are cut into short lengths of 2 feet by powerful circular saws and then barked. Two methods of barking are in common use, the "tumbler" system and the "barker" system. In the former, the short pieces are thrown into a large revolving cylindrical drum, together with a suitable quantity of hot or cold water. The friction of the pieces against each other due to the tumbling caused by the rotation of the drum, completely removes the bark, and the logs are withdrawn in a clean condition. In the "barker" system the machine used consists of a heavy iron disk provided with strong steel knives fixed to its surface, and projecting about a half inch from it.

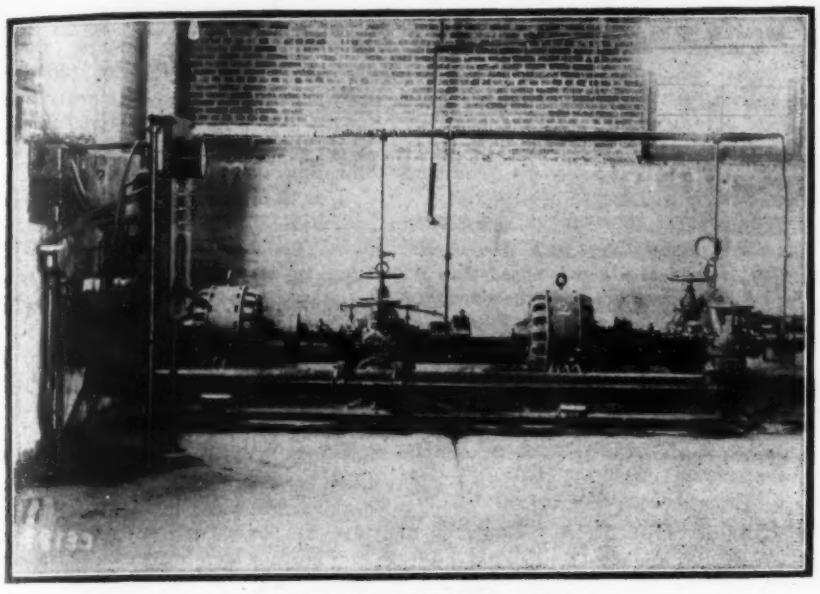
There are several types of grinding machinery used, but they are all based on the plan of forcing the wood by means of hydraulic pressure against the face of a rapidly revolving grindstone continually flooded with water, which carries away the disintegrated pulp as fast as it is produced. The grindstone is a massive heavy stone about 54 inches in diameter and 27 inches thick. It is mounted on a steel shaft and covered with a specially built iron covering. This casing is provided with several projecting chambers or pockets, into which the wood is thrown, in such a manner that the side of the log comes into contact with the face of the stone, against which the wood is forced by hydraulic cylinders attached to the pockets.

The pulp flows from the grinders over a coarse sieve which retains any large splinters or chips and it is then carefully screened. The proportion of water to pulp at this stage of manufacture is so large that it is necessary to pass the mixture through a wet press machine which produces the mechanical wood pulp in a more solid form for marketable purposes. Power requirements of pulp grinders are rather severe, ranging from 250 to 350 horsepower for 27-inch stones.

125-Horsepower Motors Driving Jordans.

Chemical Wood Pulp.

In a large eastern paper mill soda pulp is made from poplar, basswood, etc., while



Motors Driving Centrifugal Pumps.

the sulphite pulp used is brought from a distant sulphite pulp mill. The wood is received at the mills well seasoned and cut into five-foot lengths. It is then cut lengthwise in several pieces by a powerful motor-driven rip saw. The wood is then ready for the chipper wheels where it is reduced to chips about five-eighths of an inch in length. The chipper wheels make 760 cuts a minute and have a capacity of 100 cords of wood in 24 hours. Each chipper is individually driven by a 100-horsepower 440-volt squirrel-cage induction motor. From tests on the chippers cutting poplar, the highest reading was 158 horsepower and the lowest 19 horsepower, which shows the widely varying nature of the load imposed upon chippers.

The next process is conveying the chips to the digesters where the intercellular matter is dissolved. The wood is cooked for about eight hours under a steam pressure of 120 pounds, when the pulp is discharged into a pulp pit where the liquor is drained off and saved to regain the soda ash. The pulp is then ready for bleaching and refining.

Two pulps, soda pulp and sulphite fiber, are brought together in beaters and mixed with clay sizing and coloring matter. The beaters consist of large tubs shaped similar to a bath tub of enormous size. A partition extends partially across the center of the tub the longest way. On one side of the partition there is a revolving cylinder with knives placed radially in the periphery. These knives are revolved by the cylinder and pass closely over stationary knives in the bottom of the tub. The action of the revolving knives causes the pulp to keep up a continuous circulation about the beater breaking up the pulp into a uniform consistency. The approximate power required for beaters is 30 to 40 horsepower.

The pulp may be still further refined by the Jordan engine which consists of a conical cylinder in which a concentric cone revolves. Radial projections parallel with the axis of the cylinder run in close proximity to projections in the interior of the conical case. Adjustments are made by an endwise movement of the cone. The Jordans are sometimes directly connected to a squirrel-cage induction motor, the latter having an elongated secondary or rotor which permits adjustment of the Jordan without shutting down. The refining process of both mechanical and chemical pulp is somewhat similar and the next step is the operation of the paper machine proper.

Pumps of many sizes are necessary to handle the wet pulp, water, bleaching and other liquids. These are generally centrifugal and motor driven.

The principles of the "Fourdrinier" or paper machine depends upon the use of a wide, endless band of wire cloth which runs horizontally over suitable rollers. The mixture of pulp and water flows on the wire cloth and is carried forward, the water falling through the meshes of the wire, and the pulp settling on the surface of the wire into the form of a wet sheet. The stock of pulp and water is contained in a stuff chest at the wet end of the machine and is kept in a continual state of agitation by a stirrer. From the stuff chest the pulp flows into a long narrow box from which it is distributed evenly over the wire. The wire passes over couch rolls and returns back to the starting point, passing under the frame of the wet end of the machine.

From the wire the pulp is transferred to a traveling felt which carries it forward to press rolls where it is subjected to considerable pressure. The pulp, now paper, is firm enough to be dried by passing through drying cylinders. After the latter process the paper runs through calender stacks and is trimmed by a paper trimmer. From the foregoing it can be seen that the paper machine is really divided into two parts. The wire, press-rolls, dryers, and calender rolls are driven at variable speeds, and the auxiliary apparatus of the wet end at constant speed. The constant-speed part generally requires from 25 to 30 per cent of the total power necessary to drive the whole paper machine.

In a wood-pulp paper mill in Wisconsin there are two Beloit paper machines. The smaller of the two machines has a capacity of 21 tons daily at the rate of 525

300-Horsepower Motor Driving Beaters.

feet a minute. The paper is 84 inches wide before trimming and 78 inches wide after trimming. The machine has 29 dryers and a 70-foot wire; the variable-speed portion is driven by a direct-current shunt-wound variable-speed motor with a speed range of from 470 to 750 revolutions per minute. The constant-speed end of the paper machine is driven by a 50-horsepower direct-current motor of the same make. From actual tests of the paper machine while running under normal conditions it was found that 101 horsepower was used for driving the variable-speed end.

The larger of the two paper machines has a capacity of 26 tons of paper a day at the rate of 475 feet a minute. The paper is 104 inches wide before trimming and 97 inches wide after trimming. There are 25 dryers and a 60-foot wire. The variable-speed end is driven by a 100-horsepower motor of the same characteristics as that for the smaller paper machine and from tests was found to deliver 97 horsepower when the paper machine was operating under normal conditions.

150-Horsepower Motors Driving Two Beaters Each—American Box Board Company.

The constant-speed end is driven by a 50-horsepower motor. The seemingly misleading figures showing that under test the larger paper machine required less power than the smaller, is undoubtedly due to the slower speed of the former machine.

The following data will be useful in connection with super-calenders used for high-class book paper for giving a gloss finish. It is customary to start the calenders at slow speed with a small motor and thread the paper through the rolls. After the paper is in place a large variable-speed motor is started for the operation of the calenders and the small motor is automatically thrown out of gear. In this case the small motors are of the squirrel-cage induction type and the large motors slip-ring variable-speed induction machines.

The following horsepower requirements are recommended for the specified sizes of super-calenders: Super-calenders 86-inch stock; variable-speed motor 75 horsepower, constant-speed starting motor 15 horsepower.

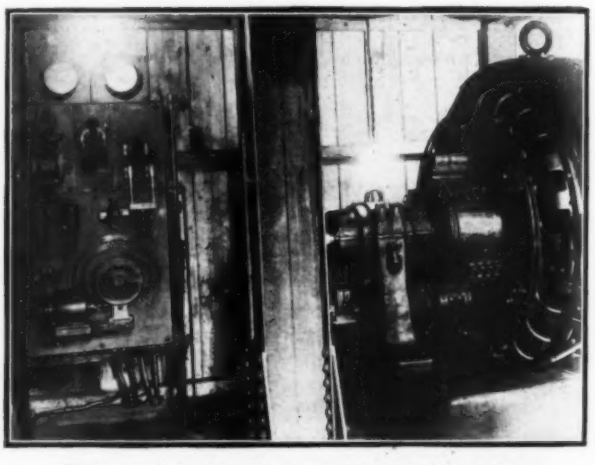
Super-calenders 72-inch stock; variable-speed motor 75 horsepower, constant-speed starting motor 15 horsepower.

Super-calenders 66-inch stock; variable-speed motor 75 horsepower, constant-speed starting motor 15 horsepower.

The dimensions of the calenders refer to the width of the paper. The narrow calenders run at a higher speed than the wider calenders, therefore the power requirements do not vary in a direct ratio with the widths. It is absolutely essential that calenders can be operated at varying speeds, under accurate speed control, in order to slow down and note the extent of defective spots as they appear in the paper.

Electric Operation Begun at World's Largest Copper Deposit.

An American diplomatic officer has forwarded the following interesting report from South America.



Motor and Control Equipment for 165-Inch Paper Machinery.

On May 18 power was turned on in the big electric plant of the Chile Copper Company, at Tocopilla, north of Antofagasta, for the operation of the mill at Chuquicamata, thus inaugurating the exploitation of the mines which officials of the company claim are the largest known deposits of copper in the world. Barros Luco, President of Chile, pressed the button at Santiago that set in motion the machinery at the port and mine. When completed the mill will have a capacity of 20,000 tons of ore daily, the plant being constructed in two units. Only one unit of 10,000 tons has been put in operation.

Although known to mining engineers the world over for many years, the low-grade deposits of Chuquicamata remained almost neglected. The native Chileans worked various parts of this great deposit in a small way, and for a short while an English company also attempted, unsuccessfully, to work a small part of it. In 1910 options for the major part of this deposit were obtained by Albert C. Burrage, of Boston, and shortly afterwards the Messrs. Guggenheim, of New York, became associated with him, the result of this being the Chile Copper Company, of which Daniel Guggenheim is president and Albert C. Burrage vice-president.

The deposit was believed to be extremely large, as the formation tor some 8,000 feet in length and 2,000 feet in width was favorable for the deposition of copper minerals, but its true size was undreamed of. It is interesting to note how the ore "in sight" has steadily grown. In January, 1913, there were in sight 75,000,000 tons, averaging 2.70 per cent copper; in June, 1914, 211,000,000 tons of 2.20 per cent; and in January, 1915, over 300,000,000 tons of 2.10 per cent copper in sight. This makes it the largest known deposit of copper in the world.

The power plant at Tocopilla has 40,000 kilowatts capacity, designed for either coal or oil fuel. A long-time contract has been made for California crude oil at a satisfactory price for the uses of the power plant and for other purposes at the mine and mill. There has been built for the mine and mill a complete equipment for housing the employees of the company; that is, stores, storehouses, hospitals, offices, dwelling houses, etc. Around the mill site there has sprung up, from what a few years ago was a barren desert, a now thriving town of 4,000 inhabitants. An agreement has been entered into with the railroad from Chuquicamata to Tocopilla to carry all the freight for the mine and the copper from the mine for a number of years at a satisfactory rate.

Kentucky broke its record of coal production with an output for 1914 of 20,382,763 short tons.

Commercial Practice
Management, Rates, New Business

COURTEOUS SERVICE.[1]

By Edward H. Mulligan.

"Courteous service" combines courtesy and service, two of the absolute essentials in the conduct of a great and successful organization. It is a most pertinent subject, approached from either angle.

Volumes have been written on "Courtesy" in each of its many phases, and yet withal, there has not been one word too much—in fact I even shall have the temerity to add a little more myself. "Service," however, seems to be the root of the subject before us, while "Courtesy," though equally important, is but the qualifying substantive, if I may be allowed the expression. It is then my purpose to try, at least, to emphasize by every means in my power, first the dignity of service itself and then point out the quality of the service that should follow as a natural corollary, viz.: "Courtesy."

In the United States not long ago, there was a movement to change the name "Servant" to something that might not so clearly convey the idea of service to the average mind, in the belief that such a title is degrading. Degrading! Think of it, when no more honorable title exists in the world today nor has existed since the world began.

From the beginning of time down through the ages, mankind has often indeed debased service itself, but never the proud title of "servant." That has always been kingly in its true significance and will remain so until time is no more. Remember the words and teachings of the Savior as our greatest example. His was a life of service—"Servant of ye all," He said, and can we have a more glorious example of the dignity of service than when our Lord served? Kings, princes, potentates have all been servants and have served with honor to themselves. Can any of us in this day and age attempt to place ourselves above those and cavil at a title that honors rather than debases? Have we thought of this side of the question, or if we have, has it been only from its ethical standpoint? True, that is its highest aspect, but have we brought it right down to our every-day life and realized that we too serve and must in honor if we be men. Do we believe service to be debasing in any degree that might affect either our work or our peace of mind? Let us see. Most of us here have in our keeping a badge of service, an insignia showing that we have served one, five, fifteen and even twenty-five years. In proof that we are proud to have this badge, consider it an honor and are jealous of our years of service, ask the auditor about the number of letters he has received in regard to the length of time we have been with the company, when the writers believed too few years had been credited to them and demanded badges, showing longer service.

"Ich Dien" (I serve) has been on the escutcheon of England's heir, the Prince of Wales, since the middle of the fourteenth century—1346. At that time, when sunny France was, as now, torn by war against its present ally, England, Edward the Black Prince lifted from the field of Crecy, the blind King John of Bohemia and appropriated as his very own, the motto found on the shield of his fallen foe. Does it look as though he believed such a motto might be degrading to himself or his house, the head of which was the puissant Edward the First?

With such examples before us must we not perforce believe and should we not by our performance preach the "dignity of service"? Then if we do indeed see the light and substantiate our belief that service is honorable, can we serve but with all courtesy?

On Sunday, October 4, 1914, the day appointed by President Wilson as a general day of prayer for peace, President Arthur Twining Hadley of Yale College took as the subject of his sermon "The Obligation of Courtesy." The Century Company printed the address in full, and speaking of it editorially, used the following words: "Something in its sanity, its breadth of human charity, its call to higher Christian sense of responsibility, its seasonable appeal for peace on earth, good will toward men, demands for it a wider audience—the audience of thinking men and women of our whole land." I too wish we all might read the address.

Knowing full well that no words of mine can have one jot or tittle of the force that so great a master of English as President Hadley gives to his utterances, I am going to quote a little from what he says, which seems pertinent to the subject we are considering:

"To bring about peace on earth, men must develop the Christian virtues of fairness and courtesy. They must try to see things as others see them; to speak and act with a view to the feelings of others, as well as themselves. This appreciation of others' point of view is the essential element both in fairness and in courtesy. They are not really different things; they are different sides of the same thing. Fairness is consideration for others as shown on the intellectual or subjective side. Courtesy is consideration for others as shown on the social and practical side."

There we have the crux, "consideration for others," the cross of our seeming stumbling in the matter of courtesy. To paraphrase President Hadley's diction, "get at the viewpoint of the other fellow in any controversy and differences will vanish, you will be on his side and remember, it takes two to make a fight." He also asks—"Do we accept the Christian obligation of courtesy to all mankind or do we limit our obligation to the narrow circle of our own immediate friends?" Let us ask each other the same question. We wish to be leaders each in his own line, then as President Hadley says in his peroration, "let us recognize the obligation of courtesy to every man and woman. Let us learn so to lead that people will work together, instead of working apart. Let us show this in our conduct toward the town in which we live. Let us show it in our conduct toward our rivals in every line of activity. Let us show it, above all, in our honest, straightforward, whole-hearted pursuit of the truth."

The desire to give one new thought on this great subject of "Courteous Service" for us to ponder on, has been very great with me in writing on this subject, and while I cannot charge myself with any intended plagiarism, it has been my privilege since the turning of the new year to read article after article by writers whose words carry weight on this great subject and I have been influenced, of course. Evidently the scanning of the work of the

1 From *Edison Current Topics.*

year 1914 has not been satisfactory in this regard to many of the thinkers in our own line of work and the determination to write, talk and preach courtesy and service for 1915 is evidenced by the articles in question. Our determination to "render unto Caesar the things that be Caesar's" (Caesar, in this case, being our consumers, those we serve, in other words, and in the "things" being "courtesy") has kept us in the front rank heretofore, and that it may help us to stay there and even advance I give you one final quotation that contains thoughts as old as time, yet ever new.

"Courtesy may have been born in the court of a prince; but it can dwell and thrive in the courtyard of a peasant. True courtesy is not an attainment of a knee-crooking courtier, bent in pandering to the freaks and passions of his lord; neither does it belong to the courtezan to whom it is but an item of her stock in trade. True courtesy, by which I mean what the French distinguish as *courtoisie de coeur* (courtesy of the heart) is an exercise of good will, or mutual respect among men of worth. It does not consist in forms, in bows, in dresses or in exchange of polite phrases. It consists in the respect which two or more self-respecting persons pay to one another. It can never deteriorate into the cajolery of a courtier or the captation of the courtezan. Genuine courtesy is a characteristic of strong men. In our medieval warfare, there was something exceedingly charming in the exchange of salutations, when two warriors met to fight in single combat. Even an enemy must have due respect shown him; a man who is not worthy of your respect is not worth fighting with. I like to ponder upon the scene of the meeting between Cromwell and George Fox. No formal politeness could be expected in the first acquaintance of these two rugged giants—the greatest of Puritans and the greatest of Quakers. In that scene, where they stood face to face, one observes and feels a veritable exchange of manly courtesy. How could it be otherwise, when souls are so deeply imbued with reverence for whatever is honest, strong, true and godlike?"

Minneapolis Company Employees Form Glee Club.

Thirty-five employees of the Minneapolis General Electric Company have formed a glee club, the principal object being the entertainment of club members at meetings of the company's Mutual Advancement Club, and other social gatherings. H. L. Panel is president, and A. A. Cavanaugh, secretary of the new organization.

A System of Accounting for Central-Station Companies.

One of the important elements in central-station practice that has been given much attention since the advent of commission regulation of utilities is accounting. In order to determine accurately and quickly the status of any utility the various state commissions have found that a reliable system of accounting, including detailed cost data, must be used by the utilities. Such a system must show a classified analysis of the income and disbursements of the company so that a study of the actual and relative profitableness of its various activities may be made; the system must also permit the ready taking of monthly and annual statements.

To devise a system that fills these and other important requirements peculiar to the central-station industry, F. A. Bowdle, of Cerro Gordo, Ill., an experienced accountant and auditor, made a special study of the subject as the result of which he has developed the Bowdle System of Accounting which is especially adapted to electric light and power companies. This system is so ingeniously arranged that it is suitable to both large and small companies and is yet so simple that a comparatively inexperienced bookkeeper can make all the entries properly. Although concise, the system is flexible enough to permit including all the details and ramifications of the larger utilities.

The Bowdle system provides neatly printed and ruled sheets on the loose-leaf plan that are assembled in binders of either heavy canvas, corduroy or leather. Included in the set are vouchers, cash journal, consumers' ledger, general ledger, collection reports, financial statement for substations or branches, and general statement. The set is relatively inexpensive and includes complete instructions for its use.

All the detailed work of the distribution of disbursements is made on the voucher, from which it is entered into the cash journal in one lump sum. Separate entries are made in this journal for each separate voucher. The vouchers are all recapped each month and the sums total of all the different accounts thereon are thus ascertained; from this a financial statement is made up for each station, as well as one for the entire property which shows up the net results very clearly.

The consumers' ledger is a very compact book taking care of 25 accounts for one year to each page. On each page each account may be proved before being carried forward, to eliminate all mistakes in the consumers' accounts. The cash journal is ruled to accommodate all accounts shown on the vouchers, as well as quite a number of other entries. Posting is very simple, as the main accounts are posted but once a month. The ledger is designed along the lines of the other books and shows debit and credit balances on all accounts.

The Bowdle system has been found to conform to the requirements for uniform systems of accounts promulgated by various state utility commissions and has been highly commended by the accounting officers thereof.

Don'ts for Meter Readers and Bill Passers.

The Dayton Power & Light Company, Dayton, O., lists the following "don'ts" for the guidance of its meter readers:

Don't talk too much.

Don't use skeleton keys.

Don't climb fences.

Don't walk across the grass.

Don't forget to clean your shoes.

Don't enter a premise without permission.

Don't fail to announce your business.

Don't deliver a bill without *reading* the address.

Don't put a bill under the door if there is a mail box.

Don't fail to put the bill under the door of a residence if there is no mail box.

Don't give a bill to *anyone* without telling him what it is.

Don't tell anyone how much his bill will be.

Don't talk with a customer about the size of his bill, but ask him to take the matter up with the cashier's office.

Don't accept requests to disconnect, read or remove meters, change addresses, etc., but politely ask the party making the request to write or telephone the office.

Don't fail to deliver a commercial bill to the office or the person in charge.

Don't make a mistake in reading a meter.

Don't *smoke*.

Don't forget that you are the only person connected with the company that the customer comes in touch with regularly; therefore in the eyes of the customer *you* are the company, so the company's good name is in your hands.

Business Brisk in Minneapolis.

The Minneapolis General Electric Company, Minneapolis, Minn., has experienced a greater increase of business during the first half of 1915 than during the corresponding period of 1914. The number of new contracts was 6,762, an increase of 33 per cent. The connected load was increased by 6,745, a gain of 44 per cent over last year. The output of 55,837,778 kilowatt-hours was an advance of 25 per cent over 1914.

Electricity in Construction of New Portland Bridge.

A field woodworking mill operated by power from the Cumberland County Power & Light Company is employed in the making of forms used in the concrete construction of the new bridge being built to connect Portland and South Portland, Me., at a cost of about a million dollars. The machinery is operated by a 15 and a 10-horsepower motor, and consists of a grindstone, American bandsaw, 16-inch planer, swinging cutoff saw, a ripsaw and a boring machine.

Fiber conduit is used in the bridge and its approaches to carry electric light and power wires. There are 16 lines of 3.5-inch Orangeburg fiber conduits embedded in the sidewalk on either side of the main bridge and under one sidewalk of the State Street viaduct. The specifications required a conduit that should not show any separation of layers of fiber when heated to 212 degrees Fahrenheit. In cutting sections of the conduit, the inside was reamed so as to allow no offset at the joints when laid. The requirements included a puncture test of 25,000 volts alternating.

The two leaves of the drawbridge will each be operated by means of a 550-volt series-wound inclosed direct-current motor running 650 revolutions per minute and capable of being turned through an angle of 90 degrees without impairment of efficient operation. The motors will be of at least 20 horsepower. Electric brakes, controllers and resistances, and double-braided rubber-covered wire, with flexible cable for connections between the movable and fixed portions of the bridge, and armored cable to be laid in the river, are called for in the contract for this portion of the structure, which is held by the Phoenix Bridge Company, Phoenixville, Pa.

The bridge is 1,200 feet long, with two viaducts at its western end 400 and 200 feet long respectively. The contracts call for its completion by next spring.

Electrical Cooking Demonstration in Canada.

Beginning July 26, the Public Utilities Commission of the city of Port Arthur, Ontario, gave a daily electrical cooking demonstration for the benefit of local consumers of current. The commission hopes by this means to create sufficient interest in electrical cooking to warrant a special rate for cooking purposes.

A complete installation, showing the cost of each individual cooking operation has been made. Afternoon tea is served to visitors. Demonstrations are given daily.

SUCCESSFUL COMMERCIAL MANAGERS.

Robert Montgomery.

Robert Montgomery, commercial manager of the Louisville Gas & Electric Company, has just turned his thirty-second year with a record of having spent more than half his years in the electrical business. Mr. Montgomery was born on a farm outside the city limits of Jeffersonville, Ind., and as soon as he grew old enough to attend the district school he was old enough to do chores on the farm. Thus he divided his time between the "cows and chickens" and his school books until he reached the mannish age of 14 years.

At this period, Bob, as he was known then, and as his legion of friends still call him, felt the sting of the electric

Robert Montgomery.

bee and he became a helper to one of the electricians of the American Car & Foundry Company in Jeffersonville. After a few months' service, the Jeffersonville Lighting Company needed a meter reader and decided to take him on its meter-reading staff. He became successively a lineman's helper, a lineman, a fireman, an engineer and a construction foreman. As a construction foreman he was in the service of the General Electric Company.

When just entering his twenty-third year, Mr. Montgomery became general manager of the Hopkinsville (Ky.) Gas & Electric Company. Later on he was manager of the Light, Power & Water Company at Lebanon, Tenn., and after this he became contract agent for the Chicago, Lake Shore & South Bend Railway, which sold power along the 75 miles of transmission line between South Bend and Gary, Ind.

Mr. Montgomery's success with the smaller companies attracted the attention of the American Power & Light Company, and when this corporation took over the Fort Worth (Tex.) property, he was called there to take charge of the new-business department. It was while contract agent of this company that he had an opportunity to show his ability as an organizer and a business getter, which resulted in the power business of that concern taking a tremendous forward jump.

In about two and one-half years, the connected load of the lines was nearly double and as a side issue to his other important duties, Mr. Montgomery managed a sales force, which placed 7,000 electric irons in Fort Worth, Tex., homes in one year. Special attention, however, was directed towards substituting electric power for steam in cotton-seed-oil mills, flour mills and other manufacturing industries in the Texas field.

This good work attracted the attention of H. M. Byllesby & Company forces and when the lighting companies of Louisville consolidated into one company under their management, Mr. Montgomery was prevailed upon to take charge of the new-business department. This was in February, 1914. In a year's time he has built up a splendid organization and has effected a co-operation between the service company and the electrical contractors to the extent that all the contractors in the city and the service company are working hand in hand. A house-wiring campaign was inaugurated in the spring of 1914, and since that 2,000 old houses have been wired and connected to the company's line. New houses to the extent of about 1,500 have been wired and added to the company's line. Just before Christmas Mr. Montgomery conceived of a novel idea of disposing of heating devices and putting this idea into effect and co-operating with the contractors and department stores, there were over 6,200 heating appliances sold between December 1, 1914, and January 1, 1915. This is without doubt the largest number of appliances sold in any city of the United States of like size during such a short period of time. During the past year the power business has increased by 2,500 horsepower. In addition to taking care of the electric department, Mr. Montgomery has had charge of disposing of natural gas and has made quite a record in this line. In fact, the first year of work in Louisville, Bob's friends think he has just gotten a fair start. Generally, we find that a man holding a position like Bob has a hobby, and if he has one, it is "work."

North Dakota Coal Production.

The output of lignite in North Dakota—the only mineral-fuel in the State—increased in 1914 from 495,320 short tons, valued at $750,652 in 1913, to 506,685 tons, valued at $771,379.

Electrical Construction

THE COMPENSARC FOR MOTION-PICTURE PROJECTORS.

By C. Walford.

The motion-picture show with its high-power arc lamp has given rise to the need of a special motor-generator. The majority of these arc lamps require 35 amperes at 50 volts. With a drop of 170 volts in a steadying resistance when operating on a 220-volt line, the loss is excessive. To meet this condition the motion-picture generator or compensarc has been produced.

When receiving power from an alternating-current source, an alternating-current motor driving a direct-current generator is sometimes used. There is, also, on the market an alternating-current compensarc, employing three choke coils to vary the flow of current; in that case alternating current is used at the lamp. In this article one type of direct-current motor and generator will be discussed.

A very brief explanation of the theory of the direct-current arc may not be out of place, as its behavior is the controlling factor in the design of this machine.

An arc may be maintained by either direct or alternating current. Under ordinary circumstances the two electrodes must be brought together before being separated to establish an arc, otherwise several thousand volts would be required to strike across the air-gap in the first place. As soon as the separation of the terminals commences, the spark, which tends to form at any break in a circuit, vaporizes a portion of the material of the electrodes, thus establishing a bridge of conducting vapor through which the current flow is maintained. The concentration of energy in a small space produces intense heat, which vaporizes the electrodes rapidly, so that a highly refractory terminal must be employed to avoid rapid consumption. Moreover, the intensity of light given out by the arc depends on the temperature to which the electrodes can be heated without being vaporized; therefore, a highly refractory substance like carbon best fulfils the requirements.

It is evident that the amount of carbon vaporized at the positive crater forming the arc stream will vary with the current, therefore the resistance of the arc, which varies inversely with its cross-section, varies inversely with the current. In this respect the arc is totally unlike solid or liquid conductors, whose resistance is independent of the current, other conditions remaining the same. Hence Ohm's law in its general form is inapplicable to the arc stream. But the resistance of an arc, like that of any other conductor, increases with its actual length and changes inversely as its cross-section.

Every constant-potential arc lamp for store lighting and the like has an automatic mechanism contained in the case whose function is to separate the carbons when the current is too high, and bring them together when it is too low. If well made and adjusted, such a regulator may respond to current variations of five per cent either side of the value at which it is set, which might be expected to maintain a practically constant current. Such, however, is not the case. An arc whose carbons are fed by a mechanism of this kind, if connected directly to a constant-potential main, will behave in the most erratic manner, even if it be started by hand regulation, and allowed to warm up before the test. The mechanism adjusted to respond to five-per-cent current variation now utterly fails to keep the current anywhere nearly constant, and the arc is very unsteady. This is true even if the voltage of the mains corresponds to the voltage desired at the arc.

The reason for it lies in the fact that the resistance of an arc decreases as the current increases, which results in a tendency for the current to become almost infinite if constant potential is maintained across its terminals. Similarly, if the current begins to decrease, and so lessen the cross-section of the arc, the resistance rises and further chokes off the current, until the arc goes out. The arc when directly connected to constant-potential mains is therefore in a state of unstable equilibrium, in which the current tends to drop to zero or surge toward infinity. This action, depending as it does only on the instantaneous cross-section of carbon vapor at any moment, is itself instantaneous. The means used to counteract the instability of the arc must operate as fast as the current change can take place, and this is the function of the direct-current compensarc.

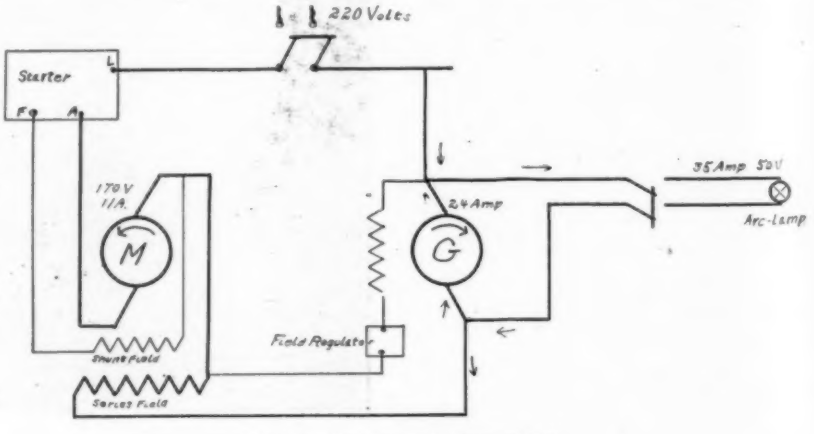


Fig. 1.—Diagram of Connections.

The compensarc manufactured by the Fort Wayne Electric Works consists of a shunt generator driven by an overcompounded motor, having both armatures on the same shaft. The two field-frames are securely bolted together and mounted on a solid bed plate. Attached to the shaft between the two armatures is a ventilating fan which draws the air from the two ends.

From a study of the simplified diagram, Fig. 1, it will be seen that the 11 amperes taken from the line goes through the arc lamp, and that the remainder of the 35 amperes is supplied by the generator at 50 volts. As the voltage on the line is 220, with a

50-volt drop in the lamp, the voltage across the motor armature and series windings is 170 volts.

The characteristic curve of an ordinary shunt-armature generator at constant speed is shown at A in Fig. 2. In this case, when the external circuit is open, the voltage of the machine is a maximum, for the field winding is connected directly to the armature and is independent of the external circuit. As the load in the external circuit is increased, the armature reaction and the volts lost in the armature increase, and the terminal volts slowly falls, which causes a smaller current to flow in the field magnets. While the iron is fairly saturated, this slight decrease in the field current makes but little difference, but as the load is further increased and the terminal volts further lowered, the armature reaction becomes of greater importance, and the exciting current becoming feebler, a point is eventually reached where the magnetization is in an unstable condition and the electromotive force drops to zero. Now drive

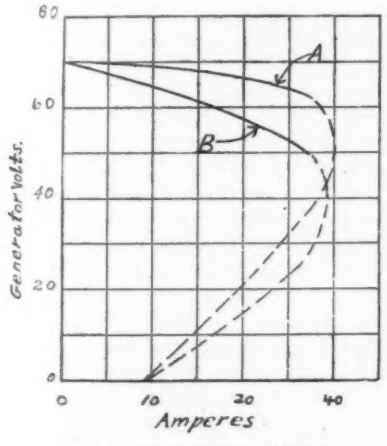


Fig 2.—Characteristic Curves.

this constant-speed shunt generator by an overcompounded motor with a speed change from 1,400 revolutions per minute at no load to 1,250 revolutions per minute at full load and the working curve B, Fig. 2, will be obtained, which is the curve of a compensarc.

From an analysis of curve B and Fig. 1 it will be seen why it is practicable to connect the lamp directly across the generator without a steadying resistance and to short-circuit the generator by bringing the carbons of the arc lamp together when striking the arc.

In the above explanation of the theory of the arc lamp, it was pointed out that as the volume of the vapor increases, the current tends to increase. This increase of current is prevented by a drop in the generator voltage due to a decrease in speed caused by the motor field flux being strengthened by the increase of current in the series coils. A decrease of the current is also prevented by the generator voltage increasing due to an increase of speed. The electromotive force of the generator varies from 70 volts at no load to 50 volts at full load. When the machine is running unloaded, the motor and the generator are in series and in opposition. Therefore, the electromotice force across the motor armature and shunt field is 150 volts when unloaded; and loaded it is 170 volts. This increase in electromotive force at the armature tends to increase the speed, but the field flux is strengthened by both the series and the shunt coils, causing a considerable lowering of the speed.

It is due to the rapid and smooth changes of the generator electromotive force, caused by the speed variations, aided by its own characteristics, that this machine has such perfect control over the current at the arc. After 15 minutes of use, when everything is warm, the generator rheostat is set and it is unnecessary to change it for a full day's run.

Static Electricity in a Textile Mill.

Static electricity is very troublesome in textile mills, especially where the belted group drive is used, unless it is removed. It has been the writer's experience that even if the belt is sufficiently lubricated, the sudden throwing on of a loom causes slippage. There is danger of lubricating the belt too much, because where the belt joint is cemented, the oil attacks the cement and weakens its hold on the leather, with the result that the joint opens up, and there is a shut down until repaired.

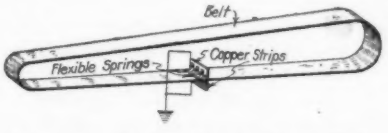
Where cotton looms are running with rubber work, it is very necessary to keep the room perfectly dry, and as it is a well known fact that a belt traveling at a high rate of speed produces a static charge, it can be seen that with a little belt slippage due to the fluctuating load, and the conditions above mentioned, it is impossible to prevent it from being generated.

A belt so charged attracts all the particles of lint which are prevalent in these mills, together with dust and other light material floating in the air, and deposits on the ceiling and on anything near the belt.

If the belt runs between the backs of looms, as the case in our own plant, this dirty and dusty lint is deposited on the back racks of the looms, and it is shaken off on to the warp during the vibration of the loom. This makes the yarn dirty and results in dirty work. Some gets on the shuttles during the weaving operation, which makes them dirty and causes them to stick. The machine therefore has to be shut down and given a general clean up.

About one year ago a 15-horsepower squirrel-cage induction motor burned out. Sparking or rather flashing was noticed between the rotor and stator. Tests were made electrically and mechanically, but everything was found O. K., except at the place of flashing, where the insulation appeared a little charred on the outside. It was not thought serious, however, and after varnishing the windings the motor was allowed to run. The motor burned out again in about one week. After it was rewound and put in operation, the flashing occurred again, and it was thoroughly tested, but no defects could be seen. The motor being thoroughly insulated and quite a distance from any ground connection, I came to the conclusion that the static from the belt would charge the rotor and jumping the air gap to the stator through the insulation, would travel along the power circuit through the ground lamps to the ground. This was a high-resistance ground connection, and the discharge would come in snaps or flashes, which weakened the insulation in time and finally caused the breakdown. I installed the home-made static arrester which I will describe.

The copper strips were placed above and below the center of the belt, as shown in the illustration. On the upper strip some small flexible springs were



Removing Static Charge From Belt.

attached. These were allowed to touch the belt as they were not stiff enough to even scratch the belt. This was grounded and completely eliminated the flashing and saved the motor from a second burnout.

The belt also carries some of the lint and dust on to the pulley end of the motor, and this is carried into the motor, by the air circulation produced by the fans on the rotor, and deposited on the windings. Also some of it gets into the oil well.

When cleaning day comes, a cloud of dust is blown out of the motors, which settles on the work in the weaving room, which has to be removed before cleaning or if not removable it must be covered up, resulting in loss of time. While it is understood that it is impossible to prevent all dust and lint from circulating around with a belt, still a great deal of it can be eliminated by removing the cause of attraction, which is static charge.

The writer has had a deal of experience with it and finds nothing as cheap and better adapted for this work than the home-made arrester described.

William T. Estlick.

National Association of Electrical Inspectors.

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H. G. Veit, Cleveland, O.

"LET THE CODE DECIDE."

Secretary's Message.

The secretary has very little to report this week. President Wynkoop has gone to Lake Champlain with two boon companions and a motor-boat. In a letter to the Secretary he states it is fitted with a new engine which "runs like a watch." Presumably he means that the three take turns winding it up once a day, and the remainder of the time can be wholly devoted to other matters of importance.

He adds: "Our Electrical Code, including a license feature, got by the Board of Aldermen on July 6—vote, 51 to 2—and is now before the mayor for signature. We have his promise and feel safe."

Clarence V. Scholl, Pleasantville, Westchester county, N. Y., and Edward W. Seelig, Beach 113th and Ocean Parkway, Rockaway Park, Long Island, N. Y., have joined the Association.

The Western New England Section held its regular meeting recently, the following being a report, as supplied by the secretary, R. J. Forsyth, of Greenfield, Mass.:

The ninth regular meeting of the Western New England Section was held in the club room of Hose and Ladder Company No. 1, South Manchester, Conn., Wednesday, July 14. L. N. Heebner, chairman of the executive committee, had every minute of the day planned for, which resulted in the most successful gathering the Section has ever had.

Through the courtesy of the South Manchester Light, Power and Tramway Company, automobile transportation was provided from Hartford to South Manchester. This enabled us to call the meeting to order in good season.

The morning session was called to order by Vice-President A. E. Hopkins, of Springfield, the roll call showing twelve members present.

Joseph H. Rohan, wire inspector for the City of Hartford, was admitted to membership. Mr. Rohan is successor to our president, G. W. Perry, who has joined the ranks of wiring contractors.

The question was brought up by the secretary in regard to members in arrears for dues, and after a discussion by the members present it was decided that the secretary be instructed to send out one more notice to members whose dues were not paid at the close of the meeting.

Plans for the fall meeting were discussed, and the Executive Committee voted to hold the meeting on October 13, 1915, at Greenfield, Mass. Plans for this meeting are to be announced later. The January meeting will be given up to a talk by Thomas H. Day on "Concentric Wiring." Mr. Day is getting together valuable information on this method of wiring, and has a complete set of fittings, which he has received from England, where this class of wiring has been in use for some time. It is intended to have this meeting open to those interested in installation of electric wires.

The question arose as to what inspectors were doing with induction-motor installations where the motors were installed in rooms where combustible dust accumulates in the motor. It was decided, after considerable discussion, that the inclosed type of motor should be required where the motor had live, exposed contacts, such as brushes or collector rings, but that a motor without these, such as a squirrel-cage, three-phase induction type, would not require housing or inclosed case.

The question: 'Does Rule 26*f* prevent the use of two conduits for a two-phase, four-wire circuit?" was also taken up. After a short discussion it was pointed out that two conduits could be used, provided the two wires of the same phase were in the same conduit.

The morning session was adjourned at one o'clock for lunch.

The members were the guests of Frank Cheney, Jr., for lunch in the banquet room of Cheney Hall. After lunch Mr. Cheney complimented the organization on its work, and extended to them an invitation to visit the Cheney Brothers silk mill.

Mr. Heebner, assisted by R. J. Dougan and J. O. McCaw, conducted the party through the fire station, which is equipped with several automatic devices designed and installed by Mr. Heebner. The balance of the afternoon was given up to an exceedingly instructive trip through the Cheney Brothers factory, starting with the raw silk and following each operation to the finished product. The power installations in the various buildings were the principal objects of attention.

At the close of the afternoon the Secretary was instructed to extend a vote of thanks to Mr. Cheney for his courtesy to the organization.

The matter appearing in this section consists of questions on the National Electrical Code, its interpretation and meaning, and questions as to whether certain methods of wiring are in accord therewith. These questions are gladly received from anyone interested, even if not a member; they should be sent to the secretary with any needed elucidating sketch. They are answered by each member of the Executive Committee according to his knowledge of what the ruling would be in his jurisdiction.

It should be understood that no pretense is made to give an authoritative interpretation of the Code. This is a voluntary association; it has representation on the Electrical Committee of the National Fire Protection Association, which prepares the Code, but it has no right, and claims no right, to give a final interpretation of anything in the Code. It is only intended to give the interpretation which seems correct to the members of the Executive Committee. No attempt is made to edit or correlate the answers from the different members of the Committee, as it is felt that the occasional difference of opinion is calculated to lead to a further study of the matter in question, further discussion and the final clearing up of obscure points.

The aim is to help toward a better understanding of the Code on the part of all; a more uniform conception of its meaning; increased precision in applying it; and harmonious action of those using it, for the common good.

Flame-Proof Wires.

Question 306.—Rules 2b and 3e state flame-proofing must be provided for wires brought close together "when required." What is your practice as to this, i. e., how many, how large, and how close must the cables be to warrant flame-proofing?

Answer 1(O). The author of the question possibly has not carefully examined the first paragraph of Rule 2*b*, which requires flame-proofing on *all* exposed insulated wires in central stations, even though 2*b*, third paragraph, and 3*e*, call for flame-proofing only "when required."

Answer 2(R)*. This, I regret to say, is a question upon which I have no experience.

Answer 3(U). I should say whenever the spacing is less than required by cleat construction.

Answer 4(M). We require that where wires are brought close together in the rear of a switchboard, for instance, that they be served with a wrap of asbestos tape where the wires are of rubber-covered insulation. Irrespective of size we do not require it where the wires break directly out of a condulet to switch or fuse studs. Nor do we require it on a form of construction which consists of "racking" wires, maintaining an air space between them of about 1½ inches. Where the wires are cleated directly to the rear of the board it is required, as the wires then are usually only about one-half inch or less apart.

Answer 5(P).* We are badly up in the air on this point in our territory and are endeavoring to find a way of establishing a ruling which shall be both fair, uniform and safe.

Answer 6(F and G). We consider the word wires to mean more than one wire. All sizes of wire are held to this rule and flame-proofing required when the conductors are less than 2.5 inches apart.

Answer 7(L). The number of cables or their size does not affect application of rule. Best practice is (1) where they are not in contact with one another and so supported as to render coming in contact an impossibility, to use no flame-proof material; (2) use circular loom tube where there is a possibility of their ever coming together; (3) use asbestos when they are together.

Answer 8(H).* Less than cleat spacing.

Answer 9(T). I believe Rules 2*b* and 3*e* are sufficiently clear on the question of requirements for flame-proofing braid that an inspector would not find any difficulty in properly interpreting these rules, and when they should apply.

Answer 10(N).* Each wire on switchboard must be flame-proofed if less than 2.5 inches apart. The only place where I permit bunching is on the small rubber-covered potential wires on less than 600-volt circuits.

Answer 11(B).* Rules 2*b* *and* 3*e* refer specifically to conductors and switchboards in central stations, etc. We have no specified distances such as are asked for by question, it being the general practice to use a tight non-combustible outer cover on conductors under conditions such as are referred to.

Two Services to One Meter.

Question 307.—Is it permissible to multiple two three-phase services which are located six feet apart in order to meter the supply with one meter instead of two? Services outside cannot be changed without great cost to power company and full capacity is required. If permissible, what form of construction is best adapted and what about wire and fuse sizes?

Answer 1(O). Rules 23*a* and 24*a* required automatic cutouts and switches on all service wires. Therefore, separate cutouts and switches should be used on both of the services referred to in this question, unless, as is provided by the Code, departure is authorized by special permission in writing. I should judge that the proper course for the inspector to follow would be to require fuses of proper capacity on each of the service wires immediately at the point of entrance to the building and then grant special permission for these wires to be brought together into one service switch in an accessible location.

Answer 2(K)*. Rule 23*a*: "the cutout must cut off the *entire* current from the building." Rule 24*a*: "service cutout and switch (singular number) must be arranged to cut off current from all devices including meters." The proposed installation does not comply with these rules and should not be allowed.

Answer 3(P)*. The Code does not prohibit this. It would be better practice to retain individual service switches and cutouts, although sometimes it is necessary, for local reasons, to couple the two services together solidly and provide one service switch and cutout.

Answer 4(R)*. Multipling such wires at the consumer's premises is poor practice, as in some cases this loop may carry considerable current at the juncture of the wires. If absolutely necessary to so arrange the service, the tie should be made at the point where the line wires attach to same, providing the public service company is satisfied no excessive current can flow. Wires and fuses will have to be governed by load conditions.

Answer 5(F and G). There should be no objection to this. The wires of each service could be of different sizes provided they are all of the same length, as the current flow would be subdivided in inverse proportion to the resistance of the conductor. This is practically the same condition as though a stranded conductor were used with strands of different sizes.

Fuses could properly be placed on each of the individual conductors, or if the wires are connected together a main fuse could be used with a capacity equal to the sum of the capacity of the separate conductors of the same polarity.

Answer 6(T). I should say that it would be permissible under the Code to multiple two three-phase services. I require that each wire be separately protected at point of entrance by fusible cutout of proper rating to protect three-phase wire, the leads then being run to one common service switch of proper size to carry full load of combined services from this switch; two leads of proper capacity could be run to meter loop and then to connected load.

Answer 7(B)*. It is permitted to multiple two services in this city, both services, however, to enter in close proximity to each other, to be properly protected by fuses or other safety devices, and to be tied together on a suitable board constructed for that especial purpose.

Answer 8(M). Yes, wires could be connected to busbar constructed of sufficient size to carry total load and held on insulators or knobs. Wires feeding busbar to be protected by cutouts.

Answer 9(H)*. I think it might be done by using a copper bus double the size of each lead, and fusing to protect it.

Answer 10(J). Yes: tie the circuits together on the street side of the meter. Fuse both of them where they enter the building.

Answer 11(U). This depends on the services. I see no reason why not, if each service had a cutout and switch. The form of construction depends on the location.

Answer 12(N)*. Yes. I should require a separate cutout on *each* wire *immediately* at the point of entrance, and *then* tie to a common bus, with cutout switch, leading to meter.

Among the Supply Men

PAYING COMMISSIONS ON CANCELLED ORDERS.[1]

By Elton J. Buckley.

The following letter, received from an Indianapolis, Ind., reader, raises an interesting point regarding the payment of salesmen. Of course the law is the same whether it be a salesman on the road, or a retail salesman who goes among customers to get orders, or a clerk behind the counter who gets a commission on what he sells:

We are having an argument with one of our salesmen which may require us to change our whole method of doing business, but before going to such length we feel like submitting the question to you. We employ several outside men, who are paid by receiving a share of the profits on their orders. There has been more or less friction between us over whether anything was due them on orders which were cancelled, but the matter has never reached a head until the present time. One of the salesmen now demands to receive regular commission on all orders he sends in which we accept, whether they are afterward cancelled or not. He states that he has been told by a lawyer that he can collect them from us. You can see that it would not be good business for us to pay a salesman for obtaining orders which we do not fill, and we could not afford to do that and would not. We are desirous of avoiding all controversy with our salesmen, however, and hope you can throw some light on the matter.

This is another complication arising from the loose and indiscriminate habit of cancelling orders, which obtains more or less all over the United States. I can tell this correspondent how he can solve his difficulty with his salesman, but he will probably not adopt it, because he will not consider it good business to do so. All he needs to do is to refuse to accept cancellations of orders. If he will do that, and will stand by it, all the orders his salesmen get, which are accepted, will be filled, and the salesmen will of course get their pay.

But he will probably not do that, so let us see what his status is under the present method.

As I have explained, all courts would probably read into every ordinary contract of purchase today, the custom allowing cancellation at will. That is, if a seller who had previously allowed indiscriminate cancellation, suddenly refused to accept cancellation of a given order, without warning, the court would say: "Mr. Seller, you can't do that. All your previous relations with your buyer allowed cancellations, and you must therefore change those relations by notice that henceforth you will not allow cancellation. Until you do that you cannot strictly hold him to his orders."

Moreover, the courts would also hold a salesman charged with notice of this custom. A salesman who does business right in the midst of the cancelling custom, who sees his own customers cancelling orders time after time and getting away with it, of course knows that any order he gets may not be filled. My judgment is that he could not collect commissions on cancelled orders, for his employer is entitled to expect—unless the salesman tells him different—that he is going along with the cancelling custom like everybody else, and that he will for himself treat as actual orders, only such as the buyer stands by.

Therefore where employer, salesman and buyer have been going along under the prevailing custom, the employer could not hold his customer to an order without first warning him, nor could the salesman hold his employer for commissions on cancelled orders without first warning him.

Particularly is this the case with a salesman who has never heretofore claimed commissions on cancelled orders, or who if he has claimed them has not enforced his claim.

But if a salesman warned his employer that hereafter he would not be a party to any cancelling of orders, that the orders he obtained were obtained in good faith, that the employer could enforce them if he would, and that if he chose not to do so, the salesman would still expect commissions, then I believe the salesman could collect every cent. The employer could no longer plead custom of the trade, for the salesman had notified him that he would no longer be bound by custom of the trade.

The only thing for an employer to do in such a case would be one of three: 1—take the same attitude with his customers and refuse cancellations; 2—pay commissions whether orders are filled or not; 3—discharge the salesman.

I think I should say that if there were no custom of the trade to change it, a salesman's commissions would be due and payable the minute he had obtained an order and his employer had accepted it. He would not even need to wait until it was filled.

1 Copyright, 1915, by Elton J. Buckley.

A. W. Zahm Organizes New Supply Company.

A. W. Zahm has resigned as president of the Minneapolis Electric Equipment Company, Minneapolis, to organize a corporation to be known as the Midland Electric Company. The new organization has taken a lease on the north half of the Elks Block, on North Main Street, Mason City, Iowa, and began business on July 15. Mr. Zahm says that the company will do a general jobbing and wholesale business, and has secured the exclusive agency for a line of motors, dynamos, glassware, lamps, etc. The new company is incorporated for $50,000, with the following officers: President, A. W. Zahm; vice-president, C. C. Carhart; secretary, Floyd E. Johnson.

Mr. Zahm was for several years superintendent of the Peoples Gas and Electric Company at Mason City, and has a host of friends in every section of that territory. T. J. Hanlon will be in charge of the city sales, and there will be two traveling salesmen covering the northern half of Iowa and the southern half of Minnesota.

Louisville Trade Board Favors Price Maintenance.

Favorable action has been taken by the Louisville Board of Trade on the subject of maintenance by manufacturers of resale prices, by which retailers are required to sell also at prices fixed by the manufacturers. This action was taken on recommendation of a special committee of which James Clark, Jr., head of the James Clark, Jr., Electric Company, was chairman, and at the request of the Chamber of Commerce of the United States for a statement of position in the matter.

Western Electric Boston Plant Abandons Outing.

By unanimous vote of the officials and employees of the Boston branch of the Western Electric Company, the annual outing scheduled for August 14, at Hingham, Mass., has been cancelled, out of

respect and sympathy for their fellows who perished in the Chicago disaster. President R. B. Hopkins and the executive committee of the Western Electric Club sent a letter of condolence to the officials of the Hawthorne Club, an orgazination of workers in the Hawthorne, Ill., plant of the company.

Idealism in Competition.

Take competition from out the dark caverns; stand it forth boldly in the searching rays of the noon-tide sun, and in the honest white light of day seek out its virtues. For years competition has been heralded as "the life of trade," yet at its door may be laid more business failures than can ever be estimated. Competition is the antagonism, strife and war of business. It is the life of the winner, but the death of the loser, while the innocent bystander pays high for the entertainment.

The competition of price cutting is not only wrong in theory but as wrong when carried into execution. On a recent public work, where competitive bids were received, the highest was $116,764; the lowest $75,404. Quite a variance, but nothing compared to another piece of work on which the top figure was $633,690 and the lowest $270,290, a difference of nearly $400,000. In neither case could the operation be carried out successfully at the figure submitted by the low bidder.

The lowest price is rarely the best price; it should never be a question of how cheap, but a question of how good. The great variance in the bids mentioned above may be charged off directly to the effort of getting business at any cost; to the hope of making up during the operation the loss that would otherwise be suffered; to the gambler's chance—to the curse of competition.

There is another kind of competition, however. It is that of self-competition, the striving to outdo the best previous performance; to have each piece of work executed stand as the best of its class, anywhere. That is competition of idealism; it stimulates and invigorates and inspires to greater, broader, and better efforts. It is the kind of competition that is now bringing about a better spirit in the world of business and a higher and finer relationship among mankind in general.

The passing order may be summed up in this wise: Business is competition; competition is war; war is hell.

Today with the vision of a glorious future, with sympathetic understanding for the hopes and ambitions of our contemporaries; with a growing desire of helpfulness, we can truly say that business is co-operation; co-operation is sustenance, and sustenance is life.—*The Hoggson Magazine.*

Unfair Competition Prohibited in Germany.

In view of the discussions on unfair competition current in this country, it is interesting to study the law on this matter enforced in Germany. This law contains some unique provisions. For example, it is not generally known in America that in Germany such expressions in advertisements as "best and cheapest place to buy," "sold at factory prices," etc., are inadmissible unless true; that actions have been sustained against merchants who displayed signs of "English spoken here" when the assertion was not in accordance with fact; that it is unlawful to attempt to entice away prospective customers standing in front of a competitor's windows; and that a tailor may be enjoined from describing his establishment as "first-class" when he pays his workers according to the fourth class in the scale of wages of the local tailors' guild.

These and other interesting facts on European commercial law have been compiled in a monograph issued by the Bureau of Foreign and Domestic Commerce as No. 97 in its Special Agents Series. It is entitled "Commercial Laws of England, Scotland, Germany and France" and may be obtained for 15 cents from the Superintendent of Documents, Washington, D. C.

In this publication, which is the work of Commercial Agent Archibald J. Wolfe, in collaboration with Edwin M. Borchard, law librarian of the Library of Congress, special attention has been given to the jurisdiction of the various courts, lawyers and their fees, costs, chattel mortgage, attachment, powers of attorney, bankruptcy laws, and laws relating to unfair competition and trusts.

Public Service Commissions

Conducted by William J. Norton

INDIANA.

Indianapolis Electric Rate Cases. The Commission issued orders, July 30, 1915, fixing rates for lighting and power to be charged by the Indianapolis Light and Heat Company and the Merchants Heat and Light Company. The new rates are to be effective September 1, 1915. Separate decisions were rendered fixing the value of the properties of the two companies. The decision on the valuation of the Indianapolis Company was written by Chairman Thomas Duncan and on the Merchants Heat and Light Company by Commissioner James L. Clark.

The value of the Merchants Heat and Light Company, including going value, supplies and working capital is fixed at $2,000,000.

As evidence to be considered in fixing the present value of the property of the Indianapolis Company, the Commission made a determination of (1) the cost of reproduction less depreciation, (2) the original cost, (3) the value of all outstanding stocks and bonds, and (4) the assessed value of the property.

(1) *Cost of Reproduction New Less Depreciation.* The Commission held that in determining the cost of the property on the basis of reproduction cost new less depreciation "the effort must be to arrive at such an estimate as a reasonably prudent and careful contractor would obtain if he were making an estimate with the view of reproducing the property under the physical conditions existing when the property was first constructed, and under present prices for material and labor. The estimate ought to be made without embarrassing minutiæ of detail."

The firm of Sloan, Huddle, Feustel and Freeman appraised the property for the company. The valuation made by the Commission staff is compared in detail with the evidence submitted by the company's engineers.

Overhead Charges. The staff allowed 12 per cent to cover engineering, superintendence, interest during construction, contingencies, etc. In the company's report 15 per cent is used for these items. In the table of the Commission's final summary of reproduction cost 13 per cent is added for overhead charges.

Working Capital. The Commission estimates the cost of reproduction of materials and supplies at $130,000, which is somewhat higher than the estimates of the company's engineers. The Commission says: "The property of the company under any of the evidence is a very large and a very valuable property. It

transacts a large business annually, receiving nearly one and one-half millions of dollars in gross earnings. It has more than 30,000 customers. The greater part of its business consists in commercial lighting and a comparatively small percent of it consists in furnishing electric power and heat. Such a business would require a larger stock of materials and supplies than would be necessarily required if the income of the plant was derived from a much smaller number of consumers. It is compelled to be prepared to furnish repairs necessarily incident to the maintenance of a great number of different services."

The Commission fixes the amount for working capital, exclusive of stores and supplies, at $125,000, and says: "In the end it is far more economical to the people to permit the utility to have reasonable earnings on a reasonable amount of working capital than to obstruct and hamper its activities by loans for temporary and trivial purposes. There is no established rule or formula by which a given per cent of the value of the property of the utility should be held as working capital. The amount should be sufficiently large to enable the utility to defray its current expenses, and to purchase its needed supplies without being driven to the necessity of borrowing or anticipating its revenues."

Summary of Reproduction Cost. The staff estimated the cost of reproduction of the property of the Indianapolis Company to be $4,893,881, and cost less depreciation to be $3,917,889; the valuation submitted for the company places these estimates at $6,004,076 and $4,843,898, respectively. The Commission's conclusions do not conform to either estimate, but upon all the evidence submitted finds these estimates to be $5,864,269 and $4,852,777. In commenting on this summary the Commission says: "This theory of the cost of reproduction less depreciation is but a device of students and courts to aid in determining the fair and reasonable value of the property. The true value may be far above the cost of reproduction less depreciation, and in this instance our conclusion is, that the fair and reasonable value of the property is much greater than the cost of reproduction less depreciation. In other instances the fair and reasonable value of the property for rate-making purposes may be far below the cost of reproduction less depreciation of the property. It is one of the means employed by courts to establish a check,—an item of evidence to be considered with all of the other methods set forth in arriving at just and reasonable value of the property for rate-making purposes."

(2) *Original Cost.* Little evidence was available regarding the investment in the property prior to 1893. The Commission's accountants, assuming that the company's records were correct as of December 31, 1893, undertook to determine the capital account invested in the property each year up to and including 1914. The total of their estimates was $5,015,715.81.

There is a conflict of about three-quarters of a million dollars between the company's and the Commission's accounts, and the Commission finds there is little evidence upon which to determine the correctness of either estimate. The Commission places an estimate of $5,400,000 as the total original cost as of March 1, 1915.

(3) *Present Value of Stocks and Bonds.* The company's total capitalization is $5,395,000 made up of $2,000,000 of common stock and $3,395,000, total bond issue, including bonds of the Indianapolis Light and Power Company. In determining the present value of the stocks and bonds the Commission says the bonds are marketable at par and the common stock is worth more than par. "It is worth, under the evidence practically 150 per cent. That is, if the company was permitted to earn six per cent on the present value of this property, after paying the interest on its indebtedness, operating expenses and taxes, there would be left an earning of seven per cent on the common stock. Stocks that will yield annually a net return of seven per cent on the par value thereof are worth more than par. There is no evidence before the Commission that would warrant a return of less than six per cent. Under this reasoning the stocks and bonds of this company are worth practically $6,000,000. We have no doubt that under existing conditions the stocks can be disposed of in a very short time at more than 150 per cent of the par value thereof."

(4) *Assessed Value.* The assessment in 1914 on the property of the company in Marion County was $2,245,100.

Going Value. Having determined the four items upon which to base the estimate of present value, the Commission says it is necessary to take into consideration the element of going value. The decision says: "The cost of reproduction less depreciation determines the cost of the bare bones of the property. That is, this sum is obtained by breaking the plant into integral parts or units, and fixing the value of each separate unit when constructed into a complete plant. The cost of reproduction less depreciation represents the value of the plant without a single customer, without a live business, with no capacity to earn revenues, but with its business yet to be obtained by its owners. That there is a difference in the value of such a plant so constructed, and that of a splendid property with more than 30,000 customers of its products, and with a revenue of nearly $1,500,000, is perfectly evident to anyone who cares to see a manifest and plain distinction. To discuss 'Going Value' is purely academic. The courts do not agree as to what it is, the engineers are as far apart in their definitions and estimates of 'Going Value' as are the laymen. The term 'Going Value' or 'Going Concern' is a device used by the courts to care for an item of value that is largely indefinable, but actually existing."

The Commission finds that there have been no substantial early losses that have not been amply restored by subsequent profits. The Commission says, however, that there are a line of court decisions which sustain the allowance for "going value" even though no losses have been sustained by the company. The allowance of 30 per cent of the structural value by the New Jersey Commission which was sustained by the Supreme Court of that State, the allowance by the Supreme Court of Oklahoma in the Pioneer Telegraph and Telephone Company case, and the court decisions sustaining the Wisconsin Commission's allowance for going value in every case, are among the examples cited. The Commission allows $400,000 for the item of "going value" of the property.

Final Value. "We have heretofore found in this opinion, that the cost of reproduction less depreciation of this plant is $4,852,777. Consequently our finding is, that the cost of reproduction less depreciation plus 'Going Value' is $5,252,777, but we believe this property is of greater value than this. Its present value is near $5,800,000. This includes improvements and additions made to March 1, 1915."

The value of the property heretofore devoted to municipal lighting is estimated at $171,772. With the municipal lighting contract transferred to the competitor, the Merchants Company, much of the property will cease to be used and useful, and the value of the property is deducted. The final figure allowed by the Commission is $5,625,000.

Reasonable Return. In regard to reasonable return the decision says: "An examination of the records kept by the company and its predecessors disclose that large earnings have been gathered into its treasury. From these earnings there has been invested in this property a large surplus taken from the people. If it enjoyed a monopoly this invested surplus in the property would justly reduce the returns on this property to six per cent. But in its field of operation it has a strong and vigorous competitor, and the rate of return should be larger by reason of this fact. The hazard arising wholly from a competitive situation is very great. Arising out of the municipal lighting of this city this company has lost within the last year at least $172,000. Having in view this competitive situation it is entitled to a return of at least seven per cent on the value of its property as above found.

Depreciation. The Commission says that there are few light and power properties where the percentage of depreciation is as small as it is for this property. Deducting $950,000 for real estate, working capital and scrap value, upon which no depreciation is figured, and $670,000 for underground conduits, cable mains, and tools and supplies, which property has the very lowest depreciation, there is but $3,630,000, in value of property where usual depreciation may occur. "In view of all the evidence we find that three per cent of the total present value of the property is a proper and adequate depreciation account."

Allowing $525,000 for operating expenses, $100,000 for taxes, $157,500 for depreciation, and $367,500 for return on the value of the property, the Commission states that the rates must provide such revenues as will yield a total of $1,150,000.

Rates. "In order to maintain this utility in the most economical way it is necessary to give consideration to large users of light and power. The ability of such users to install private plants for the production of electricity for their own use creates a competitive condition that must be reckoned with. The investment in the two plants now operating in Indianapolis is but little above the expenditures that would be necessary if these were removed and one ideal plant established. The necessities of the community require the continuous operation of these two. If the large business houses and factories of the city were to abandon the existing plants and install private ones, the cost to private consumers would be greatly increased. Yet, these private consumers are wholly unable to install separate plants. Such relief is economically imprudent and unwise. A very small margin of profit on each kilowatt of consumption adds much to the revenues of the company. As the plant must be in continuous operation, the testimony shows that the general experience of all operators has been that it is better for small consumers to serve large users at a low rate than not to serve them at all. The same evidence establishes the fact that off-peak users are entitled to some concession in rates. The Sunday user of light and power is in the same class."

The Commission says that the method of computing the cost of energy consumed ought not to be unnecessarily disturbed and that, "the rates should be, as far as possible, free from mystery. To conform to the Public Service Commission Act, the rates should be such that a citizen of average intelligence could understand and correctly apply them to his particular case. Of course, the earnings must be amply sufficient to meet the lawful requirements of the company."

A schedule is prescribed with a maximum rate of seven cents per kilowatt-hour, or 6.5 cents net. This does not include lamp renewals.

MASSACHUSETTS.

The General Laws relating to the manufacture and sale of gas and electricity have been compiled by the Board of Gas and Electric Light Commissioners, and issued in pamphlet form. The state laws, relating to both private and municipal electric and gas utilities have been extended and codified in Chapter 742 of the Acts of the Year 1914. In addition to this Chapter there have been included in this compilation certain provisions of the revised laws and subsequent acts necessary to the proper interpretation and understanding of the chapter named. A page index of the laws is given.

NEW JERSEY.

Public Service Electric Company. The Bell Electric Motor Company entered a complaint against the Public Service Electric Company in which it is stated that the complainant is using 25-horsepower motors supplied with current by the Public Service Electric Company, that the complainant has installed a direct-current generator driven by an alternating-current motor which receives current from the defendant company, that part of the direct current so generated is used in the operation of an electric sign and for lighting service, and that the respondent has notified the complainant that the use of current from the motor-generator set for lighting purposes will have to be discontinued unless arrangements are made to pay for current used by the motor at the regular lighting rates.

The Commission decides that "to allow the Bell Electric Motor Company to obtain illumination service at power rates would be an unjust and undue discrimination against other lighting customers. Service for the electric sign and for the ordinary factory illumination, whether furnished directly from the mains of the Electric Company or through the medium of a motor-generator set, should be charged in accordance with the regular lighting schedule. * * *

"It will be to the advantage of the Bell Electric Motor Company to have the sign and the ordinary office lighting supplied directly from the company's mains, and a separate meter should be installed by the company for this purpose and current supplied through this meter charged for at the regular lighting rates."

The opinion of the Commission enters into a discussion of the reason for maintaining separate rates for lighting and power service which is given, in part, as follows: "It is well understood that the maximum demand or peak load upon the ordinary generating plant is caused by the lighting load, and rates of charge take into account the fixed charge based upon the capacity of the plant.

"In the early days of the electric lighting industry, generating plants operated only from dusk to midnight, or at most from dusk to daylight the next morning. Later, electric current was sold for the operation of motors, and as the fixed charges were ordinarily covered in the rate charged for electric lighting the rates charged for power used in ordinary daylight hours were less by the amount of the fixed charges.

"As the electric power business has grown, the rates for electric lighting have been reduced, due to better operating efficiency and to the sharing of the fixed charges by the power customers, to a greater or less extent.

"In no case, however, does it appear that the peak load upon the plant caused by the power has exceeded the peak caused by the lighting load."

OREGON.

The Oregon Light and Power Company. In a decision rendered July 29, 1914, the Commission fixed rates to be charged by the Oregon Light and Power Company in thirteen towns of eastern Oregon. The complaint was made respecting the rates in La Grande and the Commission broadened the scope of the investigation to cover the rates charged in all the eastern Oregon towns. The value of the company's electric property is found to be $1,020,300 and of the gas property $27,000.

The Commission placed no value on the water rights within the boundaries of the National Forest Reserve from which the company obtains its water power, and stated that it would "not capitalize the bounty of the nation for the benefit of the individual."

The residence lighting rates ordered at La Grande and Baker are: 10 cents per kilowatt-hour for the first 100 kilowatt-hours in one month, 9.5 cents for the next 100 kilowatt-hours; 9 cents for the next 100; 8.5 cents for the next 100 kilowatt-hours; 8 cents for the next 100 kilowatt-hours; 7 cents for the next 100 kilowatt-hours; 6 cents for the next 100 kilowatt-hours; 5 cents for all over 700 kilowatt-hours. The above rates are subject to a 10-per-cent prompt-payment discount, and a minimum charge of $1.00.

Finding that the cost of serving the smaller communities is approximately 25 per cent higher than the cost of service in Baker and La Grande, the Commission ordered the following rates put in effect in all other communities: 12 cents per kilowatt-hour for the first 100 kilowatt-hours, scaled down one cent for each block of 100, to 5 cents for all over 700 kilowatt-hours.

Engineers Urge Qualifications of Utility Commissioners.

Experience in connection with public utilities should be made a necessary qualification for public service commissioners, according to a committee of engineers representing national and local engineering societies, which has addressed a strong plea on the subject to the Committee on Public Utilities of the New York Constitutional Convention. In the judgment of the engineers, men familiar with the technical, financial, commercial and legal matters which come before a public service commission are best fitted to render valuable service to the public. The committee feels that there are to be found among those connected with the public-utility companies men with as broad conceptions of public rights and of the duties to be fulfilled to the public as can be found in other walks of life.

The engineers also urge on the Committee on Public Utilities that the point of greatest importance in any plan for an organization of the public-utility commissions of the state is the preservation of the principle of continuity already established in the present public service commissions, whereby the term of office of the members of the commission expire at different times, so that only one member of the commission at a time goes out of office.

Represented on the committee of engineers making these representations are the American Society of Civil Engineers, the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the American Institute of Consulting Engineers, the New York Section of the American Institute of Mining Engineers, the Municipal Engineers of the City of New York and the Brooklyn Engineers' Club.

British Electrical Standardization.

The English Engineering Standards Committee will shortly publish the following reports which have been completed by the Sectional Electrical Committee: British standardization rules for electrical machinery; British standard specification for electricity meters; British standard specification for charging plug and socket for vehicles propelled by electric secondary batteries; British standard specification for wall plugs and sockets, five-ampere two-pin, without earthing device.

The subcommittee on electric power cables is considering the revision of the report on copper conductors. The electric lamps subcommittee will, in cooperation with the Tungsten Lamp Association, in the course of a few months consider the drafting of a standard specification for tungsten lamps, and the question of miners' electric lamps will also engage the attention of this subcommittee. The electrical accessories subcommittee will, through one or other of the several panels which are at work, shortly issue recommendations in regard to motor starters, heating and cooking apparatus, and fuses, as well as other electrical fittings. A panel upon which manufacturers are represented will revise the standard specification for ammeters and voltmeters.

The subcommittee on electrical symbols has appointed two panels, one to draw up a British list of graphical symbols for use in installation and power work, and the other to deal with telegraphs and wireless symbols. A special subcommittee will consider the important question of standards for distributing pressures for new systems, which has been brought forward by C. H. Merz. All interests concerned will be represented on this committee and it will be presided over by R. T. Glazebrook, of the National Physical Laboratory.

Louisville Jovians Hear Prosperity Talks.

A prediction that prosperity was not far off was made to the Louisville Jovians at their last luncheon meeting by Donald McDonald, vice-president and general manager of the Louisville Gas and Electric Company. Mr. McDonald referred not merely to comparative prosperity but to extraordinary prosperity, and said that the coming fall ought to see it getting well under way.

Mr. McDonald observed, while speaking on this subject, that he had lived through three panics. They all began, he said, by conservative people getting their money out of enterprises which were of dubious substantiality or out of ventures which were carrying inflated valuations. These same panics ended, he said, when people who had stopped buying wore out their old clothes and exhausted their supplies, when the merchants' stocks became depleted and their shelves bare and when the banks filled up with money which bankers were seeking to put to work.

The recent, or present, depressed condition started in the same way as the panics Mr. McDonald referred to, and the condition which was described as common when those panics terminated exists all over the country today. "All signs are right for virtually an immediate resumption of business," he said.

If the war in Europe continues, this country will find a growing market for food, manufactured and natural products in a large and important volume. If the war should end, Europe would call on this country for huge supplies.

New England Electric Stove Demonstration.

Alexander P. Maynard, Inc., of Boston, New England managers for the Standard Electric Stove Company, have been conducting a three weeks' campaign at Portland, Me., where a demonstrating kitchen with two two-compartment cookers and a standard family electric range were installed in the basement of a large department store on Congress Street.

During the demonstration a fine course dinner was served to 10 office heads of the Cumberland County Power and Light Company, and the processes of electric cooking shown to a large number of visitors. The result of the campaign was the sale of several ranges and about 30 compartment cookers.

The local central station gives advantageous rates to stove users; a service charge of $2.00 a month for four kilowatts demand, plus $1.00 a month for each additional kilowatt or fraction, and a current charge of 1.5 cents per kilowatt-hour for all current used.

A year's contract is required, but it may be discontinued after six months, in which case a charge of $10 is made for placing and removing service and meter connections. It is reckoned that the average cost to a family would be about $3.20 per month.

The Central Maine Power Company, Augusta, has recently begun a campaign to secure heating and cooking business, and has established a rate of about three cents a kilowatt-hour. A similar demonstration will be made in several Connecticut cities.

Report of Chicago Commissioner of Electricity.

The annual report for the year 1914 of the Department of Gas and Electricity of Chicago has been issued by Ray Palmer, the retiring commissioner. This report gives in detail the activities of the department, a considerable portion of it being devoted to electric street lighting. Detailed costs are given for both the old and the new types of lamps. Operating costs per lamp for the flame arc type are $32.96. Fixed charges amount to $26.80, making a total cost per lamp per year of $59.75. Corresponding figures for the 300-watt gas-filled tungsten lamps are $22.54, $17.00 and $39.54. It is shown that the cost to the city per thousand candlepower is only about one-third the cost of same in 1910 and one-tenth the cost in 1898. Performance curves are given for the new gas-filled lamps.

Sections of the report are devoted to the operation and maintenance of the fire alarm and police telegraph systems and to the Department of Electrical Inspection.

Motor Searchlights With the British-French Forces.

A searchlight lorry and its equipment manufactured specially for service in connection with the British Royal Navy is shown in Figs. 1 and 2 appearing herewith. It is an Austin standard two to three-ton lorry chassis and contains electric generating plant designed by the Austin Motor Company, Limited, of Birmingham. The dynamo runs at one thousand revolutions per minute and has an output of 120 amperes at 80 volts; it is connected up to a drum carrying the cable, the contact being suitably arranged to avoid the possibility of a fault developing from it whilst the drum is in motion. The lorry carries a two-cylinder, 12-horsepower petrol engine, with a specially designed cooling system and an exhaust silencing chamber. The plant can be used for lighting temporary quarters for officers, field hospitals, and other similar purposes. Ramps and tackle are provided to haul the trolley and projector on to the lorry. The equipment is adequate for a 31-inch projector, though that shown is only a 24-inch. The searchlight trolley runs on four pneumatic-tired wheels. The rear wheels are fitted with brake drums, the brakes being operated by hand lever at the rear of the trolley chassis; they act as a safeguard against the danger when on inclines, of overrunning the men drawing the trolley. The projector is mounted on a swivelling base and also swings in horizontal trunnions. A seat, which revolves with the lamp, is provided for the operator. Both the horizontal and vertical movements are controlled by means of worm gearing; the latter can be thrown out of gear and the light then swung into the desired position and the beam adjusted as required. The cable is attached to the trolley by means of special contact plugs, and it is constructed so that the possibility of damage or "shorting," across the ends, is obviated; provision is also made to prevent accidental breakage of the contact.

In the construction of the trolley, special attention was paid to the possibility of it being drawn over rough ground—possibly for long distances—independently of the main chassis, in the event of capture or destruction of that unit.

Some views of a number of the De Dion motor searchlight plants (supplied by De Dion Bouton) used in the French army are given in Figs. 3 and 4. The searchlights illustrated are of the Breguet type mounted on light independent four-wheel trucks, so arranged that they can either be used directly on the wagons or can be taken to any point demounted, within a range of 100 yards from the wagon, sloping channels or ramps and blocks and tackle being provided for this purpose. From the main engine a dynamo at the rear of the driver's seat is driven to provide current for the searchlights. The cable for conveying current when the equipment is operated at a distance is carried on a reel. The projectors are mounted on turntables for turning in any direction and are also adjustable for throwing a beam at any angle.

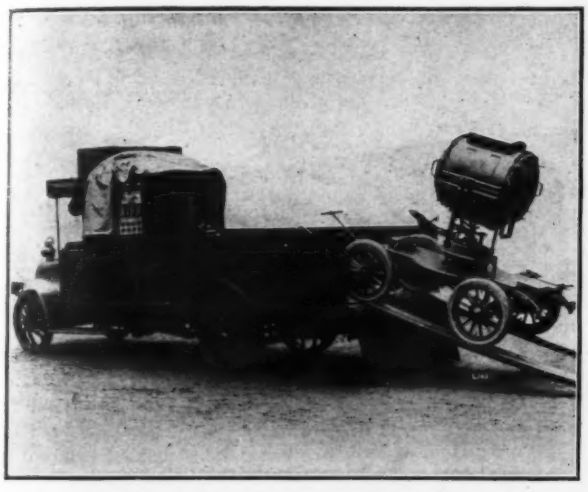


Fig. 1.—Searchlight Truck for British Naval Service.

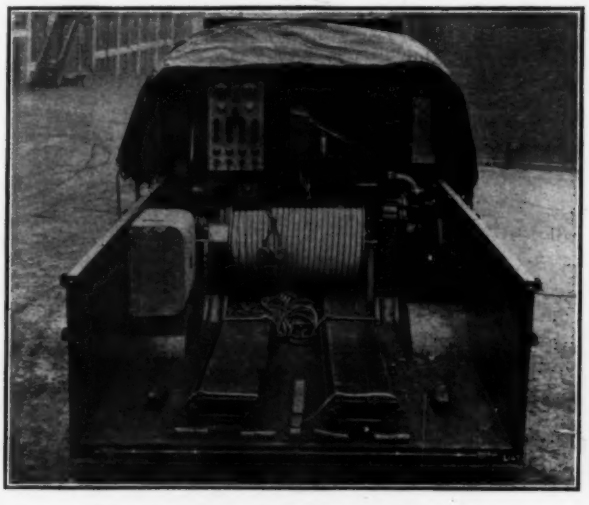


Fig. 2.—Rear View of Searchlight Truck.

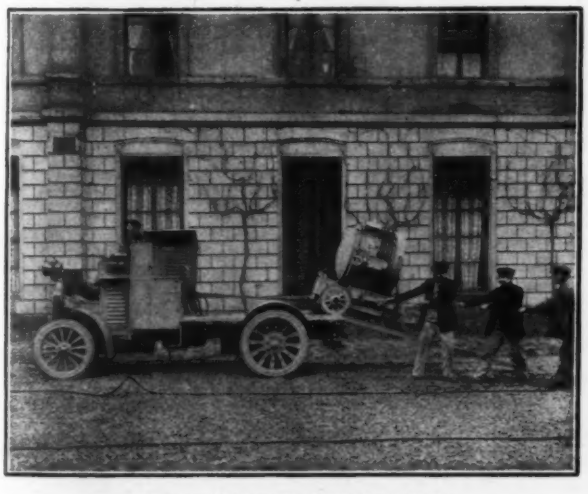


Fig. 3.—Unloading the Searchlight.

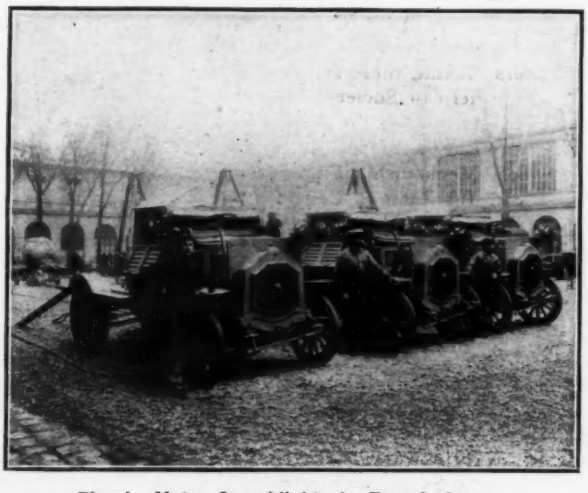


Fig. 4.—Motor Searchlights in French Army.

TEST OF A DIRECT-CURRENT MOTOR.

By H. C. Lightfoot.

The increasing use of electric drive in the manufacturing industries requires more than ever before that the men now engaged in the maintenance and installation of motors be acquainted with the standard requirements and the methods employed in making tests.

Having this need in mind it is purposed to show in the following pages what information is necessary, how this information is obtained; to give the standards; the derivation of formulas and to describe the details of an accurate test leading to the general characteristic and efficiency determinations for a motor.

Test Record.

As a considerable amount of data are to be accumulated and must be carefully preserved, it is important that a test record be prepared upon which these data can be quickly entered. A convenient and well arranged form is shown herewith, the figures entered thereon representing an actual test of a direct-current, shunt-wound, multipolar, intermittent-duty, inclosed-type motor.

Space is provided on this record for dates, identification data, service for which the motor is intended, etc., and when properly compiled, represents the complete history of the machine.

Design.

While it is not within the scope of this paper to cover the details of design, there are certain general features that should enter into the considerations when selecting a motor and which may be mentioned here.

The armature must be easily removable from the fields and bearings for repairs. It must be constructed of laminated punchings assembled and secured in an approved manner and be wound, in sizes above five horsepower, with formed coils which can be separately replaced in case of trouble. The air gap between armature and field poles should be uniform.

The field coils must be protected from mechanical injury and readily removable from the poles without damage.

The bearings should be of the self-oiling and self-alining type, the oil rings should revolve freely on the shaft and the base or feet be planed true to prevent vibration. The bearings must not leak and shall be fitted with gauges to indicate height of oil.

The field and brush terminal connections should be easily accessible. The brush leads should be of sufficient length to permit of shifting the brushes and to allow easy access to the commutator and shaft.

Cold Resistance of Armature.

The first step in preparation for a test is to measure the cold resistance of the armature winding. In order that this may be properly done it is necessary to determine the character of the winding.

There are two general methods employed in connecting armature coils, i.e., multiple-connected or lap winding and series-connected or wave winding. These windings may be identified by noting the direction taken by a coil when leaving opposite ends of an armature slot. In a multiple-connected winding the coil will turn in the same direction at the commutator end and at the rear end of the armature slot, while in the series type they will take opposite directions. (See Figs. 1 and 2.)

For multiple-connected armatures (see Fig. 1) diametrically opposite commutator segments must be chosen for the points across which the resistance should be measured.

In the series-connected, or two-circuit type, (see Fig. 2), the resistance must be measured across the segments immediately under adjacent plus and minus brushes.

A study of the winding arrangments in Figs. 1 and 2 will show that in the multiple-connected armature the paths through the winding will vary with the number of brush groups or studs, while in the series-connected type there are but two paths through the winding regardless of the number of brush groups employed.

Only two brush groups, plus and minus, are necessary for series-connected armatures in multipolar motors, but multiples of this number are frequently employed where the amount of current to be collected is large or beyond the capacity of two sets of brushes.

For the measurement of the very low resistance of large motor armatures, it will be necessary, for accurate results, to use the standard resistance and galvanometer method, but for armatures in which the resistance of the windings is comparatively large, Fig. 3 shows an arrangement of wiring and instruments which may be successfully employed and which was used in determining the resistance of the armature of the 10-horsepower motor covered by the accompanying test sheet.

In applying this test the fields of the motor should be opened and all brushes removed. Copper blocks or brushes, of sufficient size to carry full-load current, should be placed in brush holders, which will cause the blocks to make contact with the commutator segments between which the resistance is to be measured. The resistance of the rheostat R should be so chosen as to permit, with all resistance in circuit, a current through the armature not greater than 20 per cent of

DIRECT-CURRENT-MOTOR TEST RECORD.

Name of Maker—A. B. C. & Co. Order No. 500. Date—2-1-15.
Where Used—X. Y. Z. & Co. For Operating—Wood Lathe. Duty—Intermittent.
Maker's Type—A-1, Inclosed. Maker's Motor No.—12345. Maker's Armature No.—456789. Motor Type—Shunt. Armature Wound—Wave. Horsepower—10.
Volts—220. Amperes, Full Load—39.8. R. P. M.—1,250. No. of Poles—4. No. of Brush Studs—4. Brushes per Stud—2. Brushes—Carbon. Size of Brushes—1⅛x⅝x1¼ Inches. Diameter of Armature—11.9 Inches. Amperes per Square Inch of Brush Contact Surface—23.1.

Resistances	Cold at 23° C.	Hot, end of heat run	Insulation resistance in megohms
Armature between segments	.122	.143	.....
Armature between segments, at end of overload run	.....	.....	.....
Shunt field, end full load	.239.	282.	10 Armature
Shunt field, end overload	.....	.....	.....
Shunt field, end field heat run	.....	288.	15 Field
Series field	.....	.....	.....
Series field, end overload run	.....	.....	.....
Commutating pole fields	.....	.....	.....
Commutating pole fields, overload	.....	.....	.....

High-potential test, 1,500 volts A. C. for 60 seconds—O. K. Calculated horsepower and full-load efficiency—10 H. P.—85.5%.

Speed Variation.

Full load cold—1,152 R. P. M. Full load hot—1,240 R. P. M. Variation—7.6%.
No load hot—1,275 R. P. M. Full load hot—1,240 R. P. M. Variation—2.8%. Design—O. K. Workmanship—O. K. Operation at 125 per cent of no-load speed—O. K. Mechanical strength—O. K. Balance—O. K. Lubrication—O. K. Vibration and noise—O. K. Commutation—O. K. Weight—..... Weight of controller—.....

Heat Run.

Time a. m.	Line Volts	Line Amperes	Shunt Field Volts	Shunt Field Amperes	Field Volts	Field Amperes	Speed	Room Temperature C°	Remarks
10:00	220	39.8	220	0.92	....	....	1,152	23	2-hour heat run
11:00	220	39.8	220	0.85	....	....	1,188	23.	Intermittent-duty
12:00	220	39.8	220	0.78	....	....	1,240	24.5	motor
p. m.									
12:03	220	4.5	220	0.78	....	....	1,275	....	No load
12:03	220	12.	220	0.78	....	....	1,270	....	¼ load
12:03	220	20.	220	0.78	....	....	1,265	....	½ load
12:03	220	30.	220	0.78	....	....	1,250	....	¾ load
12:03	220	39.8	220	0.78	....	....	1,240	....	Full load
12:03	220	49.8	220	0.78	....	....	1,235	....	1¼ load
12:45	220	49.8	220	0.78	....	....	1,235	....	25 per cent overload
1:15	220	49.8	220	0.79	....	....	1,250	....	for 30 minutes
1:20	220	59.8	220	0.79	....	....	1,240	....	50 per cent momentary overload

Temperature Rise, Centigrade.
Without Hot Spot Correction. Maker's Ratings.

Motor Part	Full load	Overload	Motor Part	Full load	Overload
Armature core	47.5	49.	Series field	....	....
Armature conductors	47.5	49.	Commutating-pole coils	....	....
Commutator	48.5	52.5	Bearings	27.5	30.2
Pole tips	33.5	37.	Frame	25.5	29.2
Shunt field by thermometer (end of field heat run)	49.	....	Average room temperature	24.	24.
Shunt field by resistance	52.	....			

Accepted—Yes. Rejected—.....

.....Engineer.

the full-load current, and be capable of varying the current between the limits of 20 per cent and 75 per cent of full load.

Before supplying current to the armature the cold temperature should be taken by placing a thermometer (usually centigrade) on the windings and permitting it to remain about three minutes or until the true temperature is indicated.

The rheostat R should now be moved to the first contact and the terminals *a* and *b* of the voltmeter leads placed on the segments in contact with the copper blocks. Voltage across segments, and the current in the circuit, should be carefully read. Similar readings should be taken for several values of voltage and current in order to obtain a good average. In no case should the current exceed approximately 75 per cent of full-load current, so as to avoid heating the windings and obtaining false readings for the cold resistance. These readings should be taken as quickly as possible for the same reason.

The volts and amperes for each of the

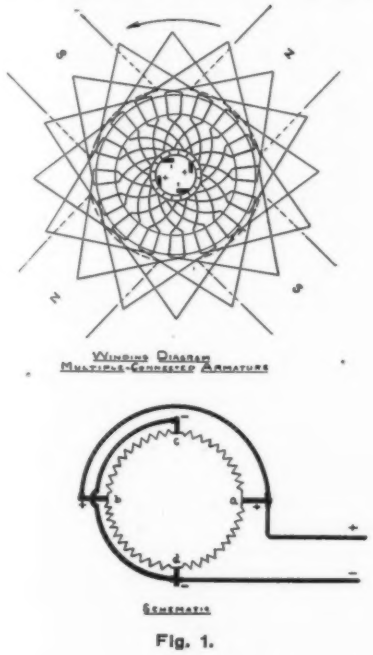


Fig. 1.

readings are used to obtain a value for the resistance, by substituting in Ohm's formula,

$$R=E/I$$

where R is resistance, E voltage and I current.

The results thus obtained differ somewhat on account of the unavoidable errors in reading the low voltage necessary to limit the current, but an average of these values will give a reasonably accurate resistance for the winding across the segments selected.

This is the true resistance offered to the passage of the current in multiple and series-connected armatures of bipolar motors, and series-connected armatures of multipolar motors, but must be modified when applied to multiple-connected armatures of multipolar machines, as the current paths through the windings of this type vary with the number of brush groups.

A diagrammatic arrangement of the relative brush positions and circuits of a multiple-connected armature of a four-pole motor, are shown in Fig. 1.

In Fig. 1, let

r=resistance of armature measured

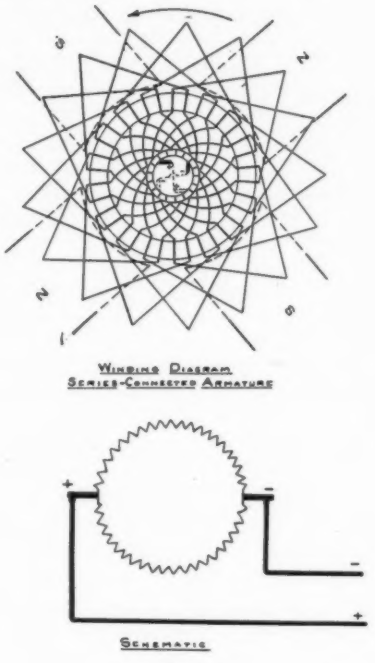


Fig. 2.

between diametrically opposite commutator segments.

$2r$=resistance of one-half the armature winding.

n=one-half the number of brush studs.

$2n$=total number of brush studs.

I=total current in armature.

R=resistance to be used in calculating the I^2R losses in armature winding.

W=watt loss or I^2R in armature winding.

Then;

Resistance of $ac=2r/n$.

Current in $ac=I/2n$.

I^2R in $ac=(2r/n)\ (I/2n)^2$.

Total I^2R in armature=$W=2r/n\ (I/2n)^2 2n$.

Simplifying; $W=I^2r/n^2$.

But; $W=I^2R$.

Then; $I^2r/n^2=I^2R$.

$$R=r/n^2.$$

This is a general formula for obtaining the value of R in multiple-connected armatures of multipolar machines. The formula considers one winding only. In the case of duplex or a greater number of separate windings on the same armature the resistance R should be divided by the total number of windings.

The cold resistance of armature is useful in finding the losses due to heating and in checking the temperature rise by the resistance method.

Cold Resistance of Fields.

The cold resistance of the field is found by substituting in Ohm's formula, as given under "Cold Resistance of Armature," the values of voltage and current in the field when first connected to the line, the figure obtained from a single calculation being sufficiently true for the reason that the higher voltage across the fields is more easily read without error. The readings should be quickly taken to prevent false results caused by heating the wire.

Brush Setting and Method of Starting.

Before an attempt is made to start the motor the brushes should be equally spaced around the commutator and set as near the neutral points as can be determined by observation, that is, in contact with the commutator segments connected with the armature coils outside the influence of the field flux.

Fig. 4 shows the method of wiring through switches and controller to obtain speed reversals, which may be accomplished by changing the direction of current through either the armature or

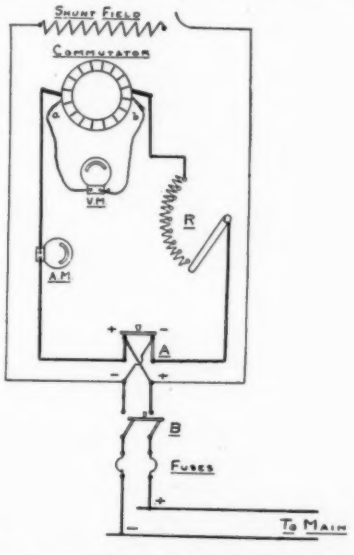


Fig. 3.—Method of Measuring Armature Resistance.

fields. While the meters in the field circuit are not necessary for the brush-setting test, they are provided for the reason that the field volts and current must be read as soon as the motor is started to obtain true figures for use in calculating the cold resistance of the fields.

By closing switch B and with controller C in the "off" position, current is caused to flow in the fields.

Under no circumstances should the armature circuit of shunt or compound-wound motors be closed before first exciting the fields. It is equally important that the fields should never be opened leaving the armature circuit closed, as the counter-electromotive force in the

armature, due to the field flux, would be immediately reduced, permitting a large and destructive current through the low-resistance winding. There are further precautions necessary which should be carefully observed to prevent damage to the field windings when closing down a motor. The load should first be reduced to a minimum to prevent heavy arcing at the switch. The switch B should then be opened, disconnecting the motor from the mains, unless a specially constructed controller is provided, and designed to cut a resistance in the field circuit to take the inductive discharge when disconnecting the field from the line. When circuit is wired as shown in Figs. 4 and 5, never stop motor by cutting out rheostat as the armature should always be in multiple with the field when the main-line switch is opened in order to provide a discharge path through the armature for the high self-induced voltage in

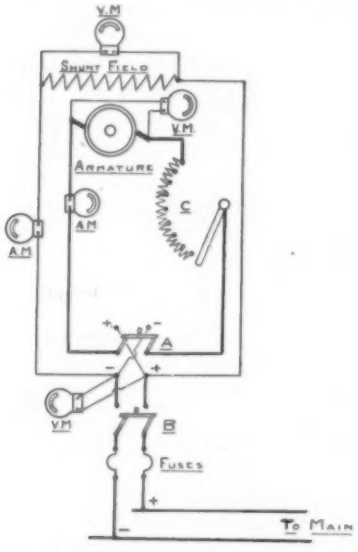


Fig. 4.—Arrangement for Brush Setting.

the fields. Unless this discharge path is provided the induced voltage is likely to puncture the insulation and cause a grounded coil.

With fields excited and without load on motor, close switch A, move controller C to the first point and gradually cut out resistance. This will cause the armature to rotate and increase in revolutions until full rated speed is attained with all rheostat resistance out and motor connected directly across the line voltage. The resistance of the rheostat should be so chosen as to limit the starting current to about 50 per cent of the full-load current.

The brush setting should be checked by taking the no-load speed of the motor in one direction, closing down and causing the armature to rotate in the opposite direction by reversing the double-pole, double-throw switch A.

The reverse speed should be read and if found to differ from that in the original direction, the brushes are shifted to a point which will give a speed representing an average of the two.

The direction of rotation is again reversed and speed noted, the process being continued until the revolutions in each direction are the same; the line voltage being held constant throughout the test.

This determines the brush setting without load. When the load is applied the neutral areas shift somewhat, due to the field distortion by the increased armature flux, and it may be necessary to move the brushes slightly in a direction opposite to rotation in order to preserve the neutral position and maintain sparkless commutation.

A change in brush setting due to load is not usually necessary in motors equipped with commutating poles.

The brushes on most carbon-brush motors are constructed and set at such an angle as to permit a reversal of the armature without damage. If this is not the case, the proper brush position can only be obtained by trial.

When the correct setting is finally determined the rocker arm should be marked to preserve the position.

Heat Run: Continuous-Duty Motor.

In order to accumulate the data necessary for the electrical determinations, a motor is subjected to a prolonged run under conditions similar to those which will be met in practice.

Before starting this run, thermometers, usually centigrade, should be secured, one each to the field coils and on opposite sides of the frame, and two suspended in the room about four feet from the motor and away from drafts to indicate the temperature of the surrounding air. The thermometer bulbs on the motor parts should be covered with small pieces of waste to retard radiation at the point of application and record a true reading.

The load for the motor is obtained by belting it to a generator whose leads are connected through a water rheostat or some other easily controlled load.

The method of wiring and instrument connections for the test run are shown in Fig. 5, the ammeter in the line indicating the sum of the armature and field currents.

Closing the switches and bringing the motor to rated speed, the load is gradually applied to the generator until full current input at normal voltage is reached in the motor.

The time should be noted, and the current and voltage in field and line, the speed, and the room temperature immediately read and recorded on the test sheet.

In order to determine the heating limits of the parts, in motors intended for continuous duty, full load is applied, taking readings at half-hour intervals until the maximum rise in the temperature of the fields is reached. As the temperature rises the resistance of the fields increases and in constant-potential coils this increase is attended with a decrease in current until the final temperature is reached. This ultimate temperature is manifested by a current of the same value through the shunt fields during three consecutive half-hour readings, with constant room temperature, indicating no further increase in resistance due to heat.

In cases where the room temperature, when nearing the end of the run, is changing rapidly enough to affect the field windings over a period of three half-hourly readings, the final heating limit may be determined by noting the difference in the temperature of the field and room. When this difference remains constant for 1.5 hours, the fields may be

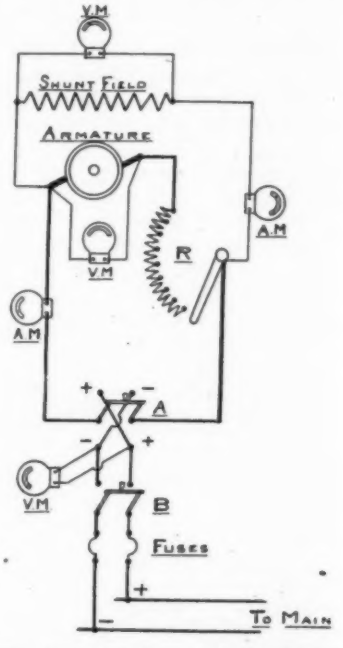


Fig. 5.—Arrangement for Heat Run.

considered to have reached the highest temperature under the conditions of the test.

Upon completing the heat run the load is changed and readings taken quickly at 25, 50, 75, and 125 per cent of full-load current input.

No-load or belt-off reading of the speed, and the volts and amperes in line and field, should also be made and recorded.

There should be no sparking at the brushes from no-load to full-load, and no injurious sparking from full-load to 150-per-cent load.

Glow points and heavy sparking should never be permitted as they soon pit and destroy the smooth surface of the commutator.

The commutator should not be cleaned or the brush setting changed during the test run.

Completing the fractional and no-load readings, which should be made as quickly as possible to prevent the cooling of

parts when current is reduced, the motor is closed down and the temperatures of the commutator, armature core, armature windings, pole pieces, frame and bearings are taken and the hot resistance of the armature measured.

Motors are also subjected to overload tests immediately upon completion of the temperature and resistance readings. For continuous-duty motors these loads are usually 125 per cent for two hours and 150 per cent momentarily, and are made to test its ability to withstand such strains without injury.

Intermittent-Duty Motors.

Motors are frequently required for service that is more or less intermittent and for this type it is considered sufficient to close down the heat run after two hours of continuous operation at full load, noting and recording temperature rises, resistance of armature and no-load readings similar to those described for continuous-duty motors.

Fractional-load readings must also be taken and 125 per cent load for thirty minutes and a momentary overload of 50 per cent should be run immediately following the heat test.

Upon completing these tests full current should be continued in the fields, with motor running light, until the maximum field temperature is reached. This is done for the reason that such motors may have a continuously excited field while subjected to load only at varying intervals and it is important to know the ultimate temperature rise for this condition.

Inclosed Motors.

It is sometimes desirable that motors be totally inclosed, and while the general requirements are the same as for the open types, it is recommended that during the heat run the hand-hole covers be not removed for the purpose of reading the field thermometers every half-hour, as it has a cooling effect upon the parts and does not conform to service conditions. The maximum rise can be determined by the field current values, and thermometers read upon closing down.

It is customary to secure thermometers to the fields of motors during the heat run, but the temperatures thus indicated are usually checked by the rise-in-resistance method, as it is difficult to always obtain a true reading due to the protecting covering of the coils. The resistance method will generally show the higher temperature rise and is therefore accepted as correct. The temperature of other parts taken by thermometer are considered satisfactory.

Hot Resistance of Armature.

The hot resistance of the armature should be measured immediately upon closing down the heat run and by the same method and across the same commutator segments employed in taking the cold resistance. This resistance, with the proper correction for the type of winding, is used to determine the I^2R losses in the armature when calculating the motor efficiency.

TABLE I.—PERMISSIBLE TEMPERATURES AND TEMPERATURE RISES FOR INSULATING MATERIALS, IN DEGREES CENTIGRADE.

Class	Description of Material.	Maximum temperature to which the material may be subjected Hottest spot.	Maximum allowable temperature rise Actual reading.	Hot spot correction Temperature measured by
A1	Cotton, silk, paper and other similar materials, not so treated as to increase the thermal limit.....	95	40	Thermometer
			45	Resistance
				10
A2	Similar to A1, but treated or impregnated, and including enamel wire...	105	50	Thermometer
			55	Resistance
				10
B	Mica, asbestos or other material capable of resisting high temperatures, in which any class A material or binder, if used, is for structural purposes only, and may be destroyed without impairing the insulating or mechanical qualities.....	125	70	Thermometer
			75	Resistance
				10

TABLE II.—PERMISSIBLE TEMPERATURES OF ELECTRIC POWER CLUB.

Temperatures in Centigrade Degrees.

Motor Part	Open Type		Inclosed Type	
	Full load	1¼ load for two hours	Full load	1¼ load
Armature winding and core, field windings, bearings, frame and pole tips.....	40	55	55	No
Commutator	45	60	60	Guarantee

Hot Resistance of Fields.

The hot resistance of the field is obtained from the field volt and ampere readings taken at end of heat run, using the same formula referred to under "Cold Resistance of Fields."

Temperature Rise.

Due to the changing temperatures of the seasons, motors are subjected to varying degrees of heat and cold and possibly upon completion of the heat run will indicate abnormally high temperature rises which may or may not be caused by the current in the windings.

The American Institute of Electrical Engineers in the revised Standardization Rules of July 1, 1915, has fixed what is considered to be safe heating limits and temperature rises for motor windings. These temperatures are given in the accompanying table.

These values are based upon a reference room temperature of 40 degrees Centigrade (104 degrees Frahenheit) which is chosen for the reason that it is probably the highest temperatures which will ever be reached by the air surrounding a motor operating under normal conditions.

As it is difficult to detect and measure the temperature of hot spots in the windings, corrections of 15 degrees Centigrade for thermometer readings and 10 degrees for temperatures by resistance, as shown in the table, are recommended as a safeguard to insure protection to the insulation.

The hot-spot temperature rise for class A1 insulation shall therefore not exceed 55 degrees Centigrade above the surrounding room temperature and the thermometer must not indicate a rise greater than 40 degrees. The indicated temperature obtained by resistance shall not exceed a 45 degrees rise.

Insulations under classes A2 and B are to meet requirements given in the table.

Tests conducted in room temperatures less than 40 degrees must conform to the same limits of temperature rise.

It is necessary to specify definite limits which may be met under the most severe conditions of operation, since a motor tested in a room temperature of 25 degrees in winter might easily withstand a hot-spot temperature rise of 60 degrees, while under summer-heat conditions the same motor would probably become overheated.

While the Standardization Rules (July 1, 1915) recognize only one temperature for all types of motors employing certain classes of insulation, the representative American manufacturers have not yet changed their ratings to conform to these requirements, contending that the probability for undetected hot spots in inclosed motors is reduced, due to a more uniform temperature within the motor, permitting a higher rating, and that under occasional overloads of short duration temperature limits may be increased without injury.

Table II gives the readings, without hot-spot corrections, for temperature rises guaranteed for stock motors as manufactured by those companies who subscribe to the recommendations of the Electric Power Club.

There are likely to be modifications which will bring the Standardization Rules and makers' ratings into agreement, but for the present the manufacturers' standards will probably obtain.

Where motors are to be operated under unusual conditions of exposure or in surrounding temperatures exceeding 40 degrees Centigrade, the specifications should so state, that the manufacturers may be informed in order to furnish a suitable machine.

Temperature by Resistance.

The method which is employed in obtaining the temperature rise in such coils as cannot be accurately measured by thermometer is shown by the formula, $r=(R_1/R-1)(238+t)$ derived as follows:

Let

r=temperature rise in degrees centigrade above the cold temperature of the coil.

t=cold temperature of coil, degrees centigrade.

R=cold resistance of coil at temperature t.

R_1=hot resistance of coil.

0.0042=temperature coefficient of copper wire at 0 degrees centigrade.

T=final room temperature.

R_o=resistance of coil at 0 degrees centigrade.

Since for each degree centigrade rise in temperature above 0 degrees the resistance of copper wire increase 0.42 per cent of its resistance at 0 degrees;

Then;

$$R=R_o(1+0.0042t)$$

Also;

$$R_1=R_o[1+0.0042(t+r)]$$

Dividing;

$$R/R_1=R_o(1+0.0042t)R_o[1+0.0042(t+r)]$$

Simplifying;

$$r=R_1/R(238+t)-(238+t)$$

$$r=(R_1/R-1)\ (238+t)$$

When the final room temperature (an average of the last four half-hourly readings of the room thermometers) differs from the temperature t of coil taken when cold, the value of r should be corrected to the rise above the room temperature by subtracting the difference between the cold coil and final room temperatures from r if the final room temperature is greater, and adding if it is less.

In previous Standardization Rules of the American Institute of Electrical Engineers, certain temperature corrections with reference to a standard room of 25 degrees centigrade were prescribed to compensate for the variations in the heat of the room and that generated by the current due to the difference in the resistance of the windings. While the principles thus employed are theoretically correct, there are other influences from radiation, atmospheric conditions, etc., which are difficult to determine accurately, and after numerous observations it has been shown that any corrections other than as now recommended are impractical and undesirable.

Speed Regulation.

There are certain variations in the speed of so-called constant-speed motors due to weakened fields caused by the heating of the windings and to the load. The change in speed from no load to full load when motor is hot should not exceed 12 per cent in sizes up to 5 horsepower or 9 per cent in sizes of five horsepower and above. A motor should attain within four per cent of rated speed under full load when hot and must never show more than 10 per cent difference in the full-load speeds, cold and hot. The operation shall be without undue noise or knocking. The end play of the shaft is usually limited to about an eighth inch.

Mechanical Strength.

The mechanical strength of armature to withstand centrifugal force should be tested by causing it to rotate, without load, at 125 per cent of no-load speed for twenty minutes. It is not practicable to specify overspeeds for series motors due to the varying operating conditions to which they are subjected.

Increased speed is obtained by cutting resistance in the field circuit, lowering the current and thereby decreasing the field flux. This results in a lowered counter electromotive force in the armature, permitting increased current flow, and producing a greater turning force and higher speed until the counter electromotive force is again increased to such a value as to limit the armature current and cause an automatic adjustment of the torque to the new field, armature and speed conditions. The reduction of the field current may be continued until the desired speed, within reasonable limits, is reached.

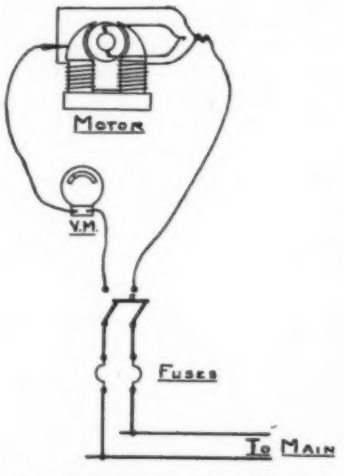


Fig. 6.—Insulation Test Circuit.

Upon completing the high-speed test the armature should be examined for loose coils, high commutator bars and mica.

Dielectric Strength.

To test the dielectric strength of the insulation to withstand the strains due to high induced voltages which would appear in the windings if the current in the coils should be suddenly broken, motors are subjected to an alternating electromotive force of twice the normal voltage of the motor plus 1,000 volts, for a period of one minute. The motor should be disconnected from the mains and the high voltage applied between the frame and the brushes in contact with the commutator, and between the frame and field windings.

The source of alternating-current supply should not be less than five kilowatts and no intervening resistance or reactance shall be used to limit the current in the test circuit should the insulation break down. The test must be made while the windings are hot, and the circuit should be properly protected with fuses.

Insulation Resistance.

The insulation resistance between the windings and frame shall be at least one megohm when hot. This measurement is usually made by the direct deflection method as shown in Fig. 6. In deriving the formula, let

X=the insulation resistance.

R=resistance of voltmeter and insulation in series.

D=deflection of full test voltage on meter.

r=resistance of voltmeter, preferably 100,000 ohms.

d=deflection of voltmeter when in series with test voltage and insulation resistance X.

Since in the series circuit shown in Fig. 6, the current flow, as indicated by the voltmeter deflection, will vary inversely with the resistance;

$$D:d::R:r$$

Simplifying;

$$R=Dr/d$$

Substituting;

$$X=R-r$$

$$X=(Dr/d)-r$$

Five hundred volts is recommended for this test. It is important that the motor be insulated from the ground during test to avoid the possibility of error should one side of the test mains be grounded.

Losses.

The motor having satisfactorily passed the foregoing requirements for heating limits, overloads, speed regulation, mechanical strength, etc., it will now be shown how the losses and efficiency are determined from the data which have been accumulated.

The losses occurring in a motor are:

(a) I^2R in the armature windings.

(b) IE in the field windings.

(c) Brush contact.

(d) Core—hysteresis and eddy current.

(e) Bearing and brush friction.

(f) Windage.

The I^2R loss in the armature is the product of the square of the current and the resistance of the windings measured as previously described.

The I^2R loss in the fields is the product of the current in the fields and the voltage producing it.

Brush-contact loss is the product of the total armature current and the voltage drop across the plus and minus brush-face contacts on the commutator. It has been found by experiment that the average face contact of good-grade carbon brushes on a rotating commutator at the customary pressure of from 1.5 to two pounds per square inch measures approximately 0.167 ohms per square inch of contact surface.

While many conditions, such as poor commutator surface, quality of brushes, dust, excessive heat and humid atmos-

phere operate to change this constant (0.167), it is a reasonably accurate figure, under normal conditions, for good-grade carbon brushes where the current-density does not exceed the commonly allowed limit of about 40 amperes per square inch at the faces, and may be used with sufficiently true results in determining the brush-contact losses.

Some manufacturers have constructed curves or collected data showing the losses for the brushes employed in their motors and it is recommended that these figures be used, if available, as the results will prove more accurate.

The total contact resistance for the brushes of a given motor is obtained by dividing the constant 0.167 by the total area of all the plus and minus contact faces. The formula used in finding the voltage drop across the plus and minus brush-face contacts is derived as follows:

Let

R=total contact resistance of all brushes.

A=total area of all brush contact faces.

E=voltage across brush contact faces.

I=current through armature.

Then

$R=0.167/A$.

Substituting the value of R in ohm's formula,

$E=0.167I/A$.

or $E=I/6A$.

This voltage drop across face contacts when multiplied by the current in the armature will give the brush contact losses.

Core, friction and windage losses are determined, in the aggregate, from the no-load test readings by multiplying the armature current by the voltage at the brushes. The figure thus obtained must be multiplied by the fraction derived when dividing the speed at full load hot by the speed at no load hot in order to correct them for the lower speed at full load. This correction is not exact for the reason that the eddy-current losses, which vary as the square of the speed, have been considered to vary directly with the speed, as is the case with hysteresis, friction and windage.

It is also necessary, for very accurate determinations, to subtract the I^2R losses in the armature at no load from the total core, friction and windage losses before the speed correction is made, as the no-load armature current appears in the total armature current at full load. But as this loss is so small compared with the total losses and is probably compensated by the error in the eddy-current figures, the result without this correction is generally considered sufficiently true for commercial requirements.

Should it be found advisable to separate the eddy-current loss, it may be done in the following way:

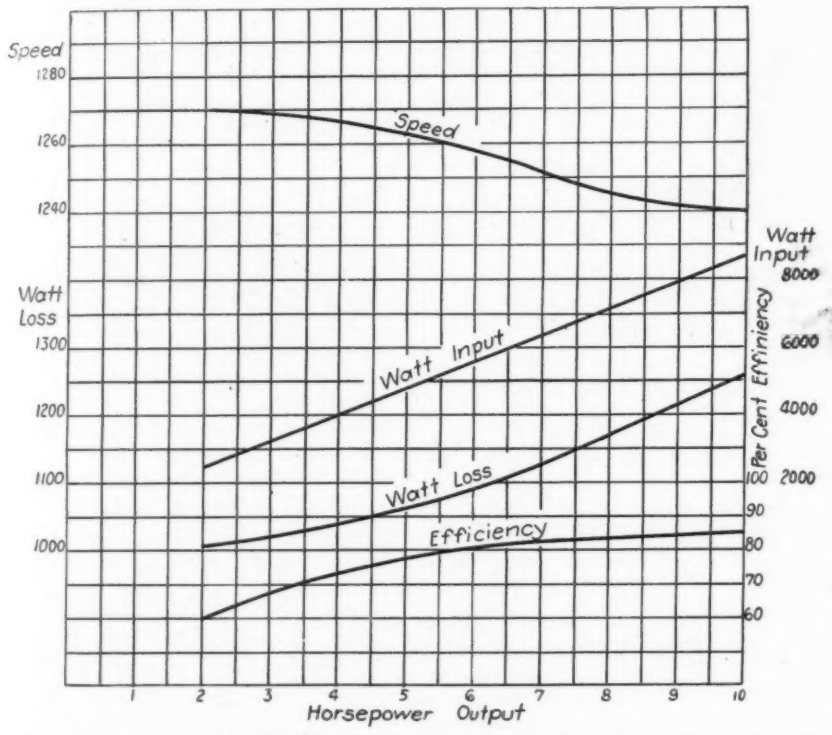


Fig. 7.—Performance Curves for Direct-Current, Shunt-Wound, Intermittent-Duty, Inclosed Motor.

Separately excite the fields from another source and maintain the current in them at the same value as during the test run. Cut a rheostat in series with the armature leads to provide means for controlling the speed. Cause the armature to rotate, running light, at one-half the speed attained at full load and calculate the watts input to armature. The formula given below is to be used in obtaining the eddy-current loss.

Let

W=friction, hysteresis and eddy-current losses at half speed.

F=friction loss at half speed.

H=hysteresis loss at half speed.

D=eddy-current loss at half speed.

K=2, or number of times the full-load speed is greater than the half speed.

W_1=friction, hysteresis and eddy-current losses with motor running light at full-load speed.

D_1=loss due to eddy currents at full load speed.

P=per cent increase in speed (in this case half speed to full speed.)

Then;

$$W=F+H+D.$$
$$KW=KF+KH+KD$$

And;

$$W_1=KF+KH+K^2D$$

Substracting;

$$W_1-KW=K^2D-KD$$
$$D=(W_1-KW)/K(K-1)$$

Substituting the value of K;

$$D=(W_1-2W)/2$$
$$D=W_1/2-W$$

And;

$D_1=D(1+P)^2$ as eddy-current losses increase as the square of the speed. The loss at any speed is therefore obtained by multiplying D by above factor.

Efficiency.

The commercial efficiency of a machine, or its ability to deliver for useful work a certain portion of the energy it consumes, is expressed in the ratio of power output to power input.

To determine the value of the output it is necessary to accumulate all the losses in the motor, add them and subtract the total from the input.

The following example serves to illustrate the method used to determine the efficiency of a motor, the figures employed being taken from the accompanying test record. The conditions under full load and at end of heat run are considered.

Let

I=current in armature at full load.

I_f=current in shunt field.

LOSSES.	WATTS.
Armature, $I^2R=(39.02)\ R=1{,}524\times0.143$	= 218.00
Field, $I_fE_1=0.78\times220$	= 171.60
Brush, $I^2/6A=(39.0)^2/3.38\times6$	= 76.20
Core, friction and windage, $I_aES/S_1=3.72\times220\times1{,}240/1{,}275$	= 796.00
Total loss in watts	1,261.80
Total input in watts at full load, $(I+I_f)E=39.8\times220$	= 8,756.00
Total output in watts	7,494.20
Ratio of output to input=efficiency	= 85.5%
Output divided by 746=horsepower	= 10.0
Full-load speed variation, cold to hot, (1,240—1,152)/1,152	= 7.6%
Speed variation, no load to full load, hot, (1,275—1,240)/1,240	= 2.8%
Ratio, full-load speed to rated speed, 1,240/1,250	= 99.0%

I_a=current in armature, motor running light.
E =voltage across brushes (line voltage).
E_1=voltage across shunt field.
R =resistance of armature, hot.
S =speed at full load.
S_1=speed running light.
A =total brush contact surface area in square inches.

In this example the no-load I^2R armature losses have not been deducted and the eddy-current losses have been considered as varying directly with the speed. (See "Losses.") As the armature is series-connected, the resistance across the segments, as shown on test record, is used in obtaining the armature I^2R losses. Had the armature been multiple-connected it would have been necessary to correct the segment-to-segment resistance by the formula $R=r/n^2$, derived under "Cold Resistance of Armature," to obtain the true resistance to be employed in calculating the armature losses.

Table III gives the efficiencies which should be met in well designed motors. For intermediate sizes not given use proportionate values. For larger sizes consult standard handbooks.

TABLE III.—EFFICIENCY PERCENTAGES.

	Continuous Service Rated Speed					Intermittent Service Rated Speed				
Horsepower	300	600	900	1200	1500	300	600	900	1200	1500
2	71	76	80	81	82	69	74	78	79	80
3	74	78	81	83	84	72	76	79	81	82
5	76	80	83	85	85	74	78	81	83	83
7.5	78	82	84	86	86	76	80	82	84	84
10	79	83	85	86	86	77	81	83	84	84
15	80	84	86	87	87	78	83	84	85	85
25	82	86	87	88	88	80	84	85	86	86
35	84	88	88	89	89	82	86	86	87	87
50 to 75	85	89	89	90	90	83	87	87	88	88

The Standardization Rules recommend that efficiency calculations be referred to a standard of 75 degrees centigrade; that is, where the winding temperatures, without hot-spot correction, differ from 75 degrees centigrade, the resistance shall be corrected to this temperature before figuring the losses. This is, however, important only when there is a wide difference between the actual and reference temperatures, and where the efficiency closely approaches the specification and it is necessary to determine very accurately whether the conditions are properly met.

It will be noted that the efficiencies for the intermittent-service types are less than for continuous-service motors of the same size. This is due to the usual practice of specifying smaller-size continuous-duty motors rated at an increased horsepower when employed for intermittent service, as they are not subjected to full-load current for long periods and can be operated at somewhat lowered efficiency and at overloads for a short time without undue heating.

Fig. 7 shows curves plotted from the fractional and full-load readings given on the accompanying test sheet. These curves are useful in studying the general performance of the motor and in finding the horsepower at any load between one-quarter and full load.

While the tests described have referred only to shunt-wound motors, the series, compound-wound and commutating-pole types are subject to the same general requirements, the additional field windings being considered when calculating the horsepower and efficiency ratings.

Bakelite Patents Declared Valid and Infringed.

The decision rendered by Judge Thomas I. Chatfield on June 12, 1915, substantiates the claim made by the General Bakelite Company that three of its Bakelite patents were being infringed by George J. Nikolas, of Chicago, trading as George J. Nikolas & Company.

The United States patents declared valid and infringed are: No. 954,666 of April 12, 1910; No. 1,018,385 of February 20, 1912; No. 1,037,719 of September 3, 1912.

The trial of the infringement suit was begun December 9, 1913, and conducted in the United States District Court, Eastern District of New York, with Judge Thomas I. Chatfield presiding. A decree was rendered June 29, 1915, and an injunction issued July 1, 1915.

The claims of the General Bakelite Company were vigorously contested by the counsel for Mr. Nikolas, who presented in their defense of the case no less than 47 patents, together with many literature references. Each one of the many patents and references cited were alleged by them to contain prior disclosures. The decision of Judge Chatfield, however, rejected all of these allegations and held the three Bakelite patents in suit to be valid and infringed.

It is interesting to note in Judge Chatfield's decision that he shows appreciation of scientific research, stating: "The testimony shows commercially successful accomplishments, as well as scientific investigation by the patentee in this country, and his appearance and testimony upon the witness stand have plainly shown mental capacity, scientific knowledge and deductive ability which would accord with and be expected as the necessary foundation for such investigations and experimental operations as those involved in practicing or advancing the art and processes set forth in the patents as to which the present litigation has arisen."

LETTER TO THE EDITOR.

Style Versus Dogma in Lighting.

To the Editor:

Glare from light sources is one of the things which the Illuminating Engineering Society has fought valiantly to overcome and the results judging by present day practice are better than the most enthusiastic of the Society's supporters in its early days could have reasonably expected. Five or six years ago, which was before the days of semi-indirect and indirect lighting, the proceedings contained specific recommendations from such men as Bell, Sharp and Marks to keep the intrinsic brilliancy down to .5 candlepower per square inch. During this same period others were advocating efficiency at any price.

The consumer settled the controversy by accepting the more hygienic method, but for reasons far removed from those of eye protection.

Women wore short skirts and low shoes last winter and furs are in evidence this summer, so that we men of brains must realize that style settles many problems and style settled the lighting problem of diffused versus direct lighting.

Style decrees that direct lighting and higher intrinsic brilliancy are coming back into favor. What are we men of science going to do about it?

New York, August 2. A. Glow.

J. G. White Companies Urge Men to Join Militia.

Three large engineering corporations in the United States have taken definite action in the encouragement of employees to join the National Guard. These are the J. G. White Engineering Corporation, J. G. White & Company, Incorporated, and the J. G. White Management Corporation. Gano Dunn, president of the J. G. White Engineering Corporation, said:

"Arrangements to release men for military service is more difficult for corporations like the White companies because of the highly specialized nature of the engineering and associated work that they carry out, which requires the personal attention of individuals in a way that does not readily permit of the substitution of others to fill their places during absence. Also as a class the men are high salaried men who have particular responsibilities and are scattered over a large territory. It is felt, however, that the sacrifices involved in encouraging these men to enter the National Guard and assuring them of their positions with pay during absence for service in militia in addition to their regular vacations are small in relation to the great importance of fostering the spirit of readiness for patriotic defense."

New Electrical and Mechanical Appliances

Flaring Porcelain-Enameled-Steel Reflector.

A new type of enameled-steel reflector for use in commercial and industrial establishments has recently been placed on the market for use primarily with the 60-watt short-base tungsten lamps. The reflector diameter is 14 inches and the shape is such as to give a very good distribution of the light upon the working surfaces. The reflector is equipped with a standard Hubbell contractile collar which permits it to be attached directly to the sockets and eliminates the need for a separate shade-holder. The reflector is finished with a high grade of porcelain enamel, which protects it thoroughly from corrosion. Ample ventilation is provided by means of four vents in the top of the neck of the reflector.

New Enameled-Steel Reflector.

These reflectors are manufactured by the firm of Harvey Hubbell, Incorporated, Bridgeport, Conn.

Adapti Connectors for Armored Cable and Flexible Metallic Conduit.

In order to be able to connect steel-armored cable or flexible metallic conduit to switch boxes and outlet boxes various types of connectors have been placed on the market that meet the requirements more or less satisfactorily. A new type of this class of device with unique features has recently made its appearance. This is made in two forms, of which Fig. 1 shows the connector for loom switch boxes. This type of connector is made of sheet steel of sufficiently heavy gauge to withstand any strains to which it may be subjected. This stamped sheet steel is bent into the form shown. The neck of the device is made to fit into the knockout of all standard loom switch boxes. It has a smaller diameter than the rest of the device so as to form a shoulder on the inside of the box for the conduit or cable. The inner edge of this neck is rounded off to form a smooth entrance bushing for the wire.

The open side of the connector is doubly split so as to form two pairs of ears. The inner set of ears provides a means of expanding the neck of the collar so that it fits firmly in the knockout of the box; this is done by tightening the screw against the unperforated ear. The other pair of ears at the outer edge provides a means for clamping the armored cable or flexible conduit by being drawn tightly about the same by means of clamping screw.

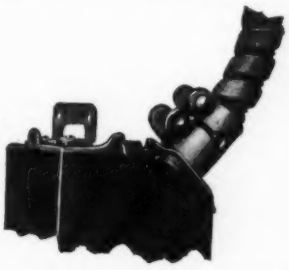


Fig. 1.—Connector for Switch Box.

The connector shown in Fig. 2 is adapted for securing armored cable or flexible steel conduit to standard outlet boxes. The general principle of this connector is the same as that shown in Fig. 1, but in this case it is made of malleable iron heavily galvanized. It fits all one-half-inch conduit knockouts. A shoulder is provided for fitting against the edge of the box.

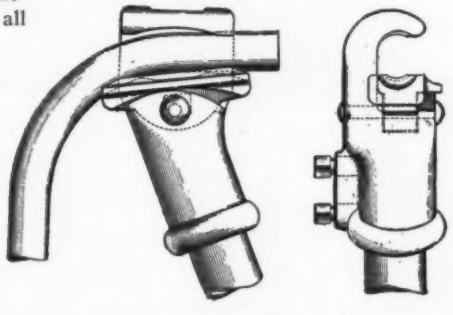
Fig. 2.—Connector for Outlet Box.

Both types of these connectors are unique in being one-piece devices and in eliminating special locknuts and bushings. They are very quickly applied and provide a secure connection to the box. These connectors are made by the Adapti Manufacturing Company, 919-925 West Street, Cleveland, O.

New Hickey for Conduit Installations.

The fact that many cities have already passed ordinances making compulsory the placing of all wiring in buildings in steel conduits tends to show that this practice is soon destined to become general. New systems and new methods require new tools. Many contractors today use an iron pipe tee, a size larger than the pipe to be bent, placing a piece of pipe in the tee for a handle, this giving a sort of wrench with the handle at 90 degrees to the conduit, which is effective, but very inconvenient in many situations. One advantage, however, is that when the tee is new it will not slip on the conduit, and when it becomes worn smooth it can be cheaply replaced with a new one.

Others use a sort of solid wrench with two fixed jaws with an opening or slot on one side between them to permit placing on the conduit without having to slip it over the end. The jaws are curved to fit the circumference of the conduit and belled at one end to an easy curve to prevent flattening or kinking. The bearing faces of the jaws are serrated or roughened to prevent slipping. This tool is open to the same objections as the tee in that as soon as it becomes worn smooth it will slip on the conduit, making it very difficult to make satisfactory bends. This causes continuous losses of time and sometimes produces bad falls and strains to the men, usually resulting in a return to the use of the tee as up to date no better tools have been offered.



Front and Side Views of Hickey.

The Fey Specialty Company, 71 Brainard Street, Detroit, Mich., has just brought out a new tool to meet

all the above requirements as well as many others which in regular practice are continually arising. This tool is known as the Fey hickey. It is provided with one solid and one movable jaw, the latter of which, operating by all the pressure required to bend the conduit, automatically clamps it while the bend is being made. This makes slipping impossible, and the jaws are smooth when new, roughening being unnecessary. A glance at the illustration on the preceding page will show clearly how it operates.

The jaws are made alike at each end, so that bends may be made by moving the handle in either direction. In one case the handle at the commencement of the bend will have an agle to the conduit or about 55 degrees, and in the other the angle is about 100 degrees. This variation in operating position provides a tool adapted for use in all kinds of close, cramped positions and meets all the conditions of service. The jaws are also so curved that the tool may be put on or removed from a conduit already bent, without turning it sidewise or slipping along to the end or onto a straight portion of the conduit.

Another improvement lies in the method of attaching the pipe handle, which is slipped into a socket slightly tapered at the inner end, but not threaded. It is driven in tight and retained by two set screws. The maker claims that handles screwed in often break off at the threads. The tool is well made of malleable iron and fully guaranteed by the manufacturers.

Meter for Demonstrating Lamp Economy.

In order to impress on prospective purchasers the economy of the new high-efficiency lamps the declarations of a lamp salesman are not nearly as effective as an actual demonstration of this point while it is being discussed. Lamp efficiency in watts per candle does not mean much to a prospect compared to a visual proof of relative efficiency of modern and old-style lamps.

With these ideas in mind the engineers of the Eldredge Electric Manufacturing Company, Springfield, Mass., have developed a convenient portable meter, known as the "duplex lamp tester." The accompanying illustration shows that it consists of a direct-reading wattmeter, two handy special lamp sockets, with a push-button switch for each, and a connecting cord with attaching plug, all being contained in a compact carrying case.

Duplex Lamp-Testing Meter.

The instrument can be used on direct-current or alternating-current circuits of standard voltage (110 volts) or thereabouts. The watt scale reads to 130 watts in the standard meter, making it especially useful for salesmen demonstrating high-efficiency lamps for households, small stores and the like. For convenience in inserting or withdrawing the test lamps, spring sockets are used in place of the regular screw-shell type. By pressing the buttons in succession the two lamps are lighted in turn and their wattage consumption indicated at the same time. This shows forcibly the difference in power consumption of the lamps compared, also their difference in brightness in case two lamps not equal in candlepower are used.

The connecting cord is four feet long and provided with a swivelled plug, making it easy to connect to the nearest outlet. The leatherette carrying case is only 5.5 by 4 by 2 inches. Despite the utility of this instrument, its cost is not very high.

Motor-Driven Deep-Well Pumping Head.

Every person situated out of reach of city water mains realizes the need of an abundant supply of good water. The owners of dairy and truck farms, country estates, and practically every water consumer dependent on some local source of water supply and situated in a locality where water does not lie near the surface, should be interested in the new Hill deep-well pumping head shown in the accompanying illustration.

When operating two-inch, two-and-one-half-inch or three-inch single-acting cylinders it will raise water to a total height of 180, 125 and 90 feet, respectively. It can be used with any of the common forms of well cylinders.

The machine is wholly self-contained and is very compact. All parts are sturdily constructed of the best materials and the mechanical construction and design insure long life with a minimum of repairs. All gears are machine cut and, as the illustration shows, are well shielded.

This head can be used in connection with open or elevated-tank systems or with closed-tank pneumatic-pressure systems. When used with the pneumatic-pressure system, an air pump furnishes air to the tank through the water discharge. Water is raised on the upstroke, while air is forced in on the downstroke, thus equalizing the pressure.

Electrically Driven Deep-Well Pumping Head.

The motors used on these heads are three-fourths-horsepower Westinghouse single-phase type AR. The motor is mounted rigidly on an extension of the pump support and is capable of starting the pump under full load.

The whole outfit is very compact, quiet in operation and extremely economical. It can be operated 24 hours every day and requires practically no attention after being started.

Automatic Electric Cooker for Steam Cooking on Improved "Fireless" Principle.

The use of the so-called "fireless" cookers, in which previously prepared and heated food is placed into a closed, heat-insulated cooking chamber, has been steadily increasing because this has been found an economical method of preparing many savory dishes that otherwise would require prolonged cooking and frequent attention at the stove. This method as ordinarily followed has some disadvantages, however. The food must be preheated and transferred to the cooker. If a number of dishes are in the cooker at the same time, one is likely to take up the odor and flavor of the other. Since no additional heat is supplied to the ordinary cooker after it is once charged, the food slowly cools and is therefore apt to be insufficiently cooked, besides requiring to be reheated before serving.

These disadvantages have been entirely overcome by the improved form of the automatic electric-steam cooker manufactured by the Good Housekeeping Cooker Company, Berkeley, Cal. Moreover, by the addition of the two hot plates shown at each side on top in Fig. 1, it is possible to perform other cooking operations quickly, such as frying, toasting, quick boiling, etc., for which a closed cooker is unsuitable. These hot plates are each two-heat electric disk stoves entirely independent of the main cooker. The heating element of each is made of two units of Nicrome wire. The heat is changed from half to full heat, by placing one of the connecting plugs from the middle to the end contact; the circuit is opened by pulling out either connecting plug; thus switches are entirely dispensed with for this purpose.

The construction of the cooker proper, which is the main part of the outfit, is made clear by Fig. 2, a sectional view of the interior chambers. In this *AA* is a double-walled steam jacket about the cooking chamber that holds the various cooking vessels, *a*, *b*, *c*, *d*. At the bottom of the steam jacket is an annular space *W* containing a limited amount of water. Below this is the heating element *H*, shown detached at the lower right corner. In the middle of the bottom is a phosphor-bronze spring diaphragm *D*, whose operation is subject to the steam pressure in the jacket *AA*. Since this jacket is hermetically sealed, the steam generated by the boiling of the water at the bottom is confined and the steam pressure therefore gradually increases. When it reaches about 15 pounds per square inch it is sufficient to buckle the diaphragm *D*, forcing it down so that it pushes a pin *P* downward and this suddenly opens the switch contacts *CC*. This automatic quick break of the circuit takes place when the temperature reaches about 250 degrees Fahrenheit, the boiling point of water being higher than 212 degrees under pressure. When the cooking chamber has absorbed enough heat to bring the steam temperature down to about 220 degrees, there is insufficient steam pressure to hold down the diaphragm; consequently it buckles back and the contacts *CC* are quickly closed by gravity and a lead weight. This restores the heating circuit and generation of steam is resumed. This cycle automatically repeats itself, keeping the cooking vessels constantly at a temperature between 220 and 250 degrees, in other words well above the boiling point of the cooking food, as long as the main circuit switch is closed.

The main switch may be non-automatic or automatic, as shown in Fig. 1. The clock shown is an automatic time switch, which closes the circuit and starts the heating at any time set. Thus the food is prepared, put into the aluminum cooking vessels and the time switch adjusted. The housewife may then go about other duties or pleasures, leaving the cooker to start cooking automatically at the proper time and continue keeping the dishes thoroughly hot until it is desired to serve the meal, everything being then completely cooked and instantly ready. It is this decided time and labor saving, together with the wholesome and deliciously appetizing results of this method of cooking, that has appropriately suggested the name "Good Housekeeping Cooker" to this automatic electric device.

In operation the cooker has been found quite economical. Between the steam jacket and the outer shell, not shown in Fig. 2, there is a two-inch space filled with packed cork and mineral wool as heat insulation. The cork has been ground and roasted to remove volatile and odor-producing constituents. This thermal insulation has been found to hold 80 per cent of the electric heat generated for 14 hours. Current is used only intermittently; when the temperature has reached 250 degrees, the circuit is open eight to ten minutes; when the temperature has

Fig. 1.—"Good Housekeeping" Automatic Electric Cooker with Two Auxiliary Disk Plates for Quick Cooking.

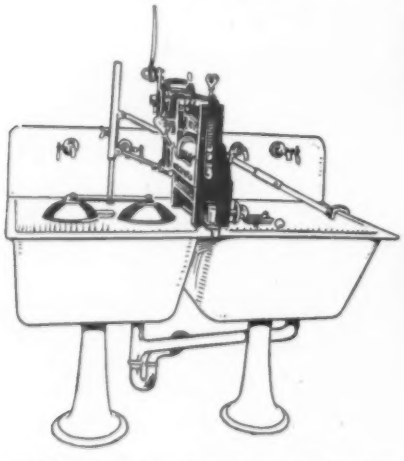
Fig. 2.—Sectional View of Interior Construction.

dropped to 220 degrees, the circuit is closed for two to three minutes, depending on the amount of food being cooked. The maximum consumption of the cooker proper is 550 watts.

Every part of the equipment is well constructed and the entire outfit is guaranteed for three years. The outside shell is of Wellsville polished steel with heavily nickel-plated trimmings. The double-walled steam jacket is made of copper electrically welded at all seams. The automatic-switch contacts are of carbon. Electrical parts are insulated with porcelain, mica and glass. Each cooker is tested at 1,000 volts for insulation. The complete outfit is neatly proportioned and finished, presenting an attractive appearance. Considering its many distinctive merits this cooker should find a place in every progressive household.

Electric Washer for Use in Stationary Tubs.

An electric washing machine, known as the Kelman or the stationary-tub electric washer and embodying many new and radically unique features, has been developed by the Kelman Elec-



Electric Washer and Wringer for Stationary Tubs.

tric & Manufacturing Company, Los Angeles, Cal., and is now being placed on the market. This machine washes, wrings, rinses, and blues in any stationary tub and eliminates all handling of water by the operator, since the regular plumbing fixture fills and empties the tub for her. Being mounted on the stationary tub, the machine is entirely out of the way, yet it is always ready for use, and avoids all getting ready and putting away of the equipment.

The well known vacuum principle of washing is utilized; the smooth vacuum cups wash clean clear through the fabric without injury thereto. It is said that anything from the most delicate and sheerest laces to rag-rugs, heavy bedding, or blankets can be washed without tearing or injuring the goods in any way.

The operation is extremely simple; one operating handle, by a slight movement one way or the other, governs the action of the wringer or washer. To reverse the wringer, the motor is reversed by means of an ingenious four-point attachment plug. This reversing it electrically instead of mechanically eliminates the complicated gearing otherwise required.

Safety of operation is provided for by inclosing the mechanism; by a safety pressure release on the wringer, whereby pressure can be instantly removed from the rolls; also by the four-point attachment plug, which may be quickly detached, stopping the washer or wringer immediately.

Long life and freedom from repair is insured by the simple and substantial construction. Worm and gear mechanism, running in ball bearings with ample provision for lubrication, reduces friction and wear to a minimum.

By loosening a thumb-screw, the motor may be removed for other purposes. Simple accessories facilitate its use as a sewing-machine motor, or to operate small grinding or buffing wheels, and save the cost of the additional motor usually required with such apparatus.

Fig. 1.—Fargo Ground Point, Type A, Unassembled and Complete.

Fargo Ground Points.

The great importance nowadays placed on grounding of transformer secondaries, neutrals, etc., is calling for more reliable means of connecting the ground wire to the grounding device. This matter has been given attention by the Fargo Manufacturing Company, Poughkeepsie, N. Y., which has brought out two types of ground points. Fig. 1 shows the three parts of this device unassembled and at the right the device complete. A cross-sectional view is shown in Fig. 2, which gives a good idea of the compression principle used in clamping the wire very securely.

This device, known as the type A, is made for different ground wires from No. 9 to No. 0 B. & S. gauge. The conical split wedging sleeve shown at the middle in Fig. 1 is placed inverted about the lower end of the ground wire

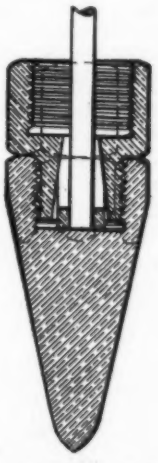


Fig. 2.—Section of Type A Ground Point.

and the latter then inserted into the socket of the ground point proper. The clamping nut shown in the upper left corner of Fig. 1 has its lower end conically tapering inside. When this is screwed over the split conical sleeve a powerful gripping connection is effected between the wire and ground point. The upper end of the nut is internally threaded for pipe to protect the ground wire. Pipes ranging from one-half to one inch are used for the different sizes of ground points. The entire device is made of tough metal and provides a durable, low-resistance ground connection.

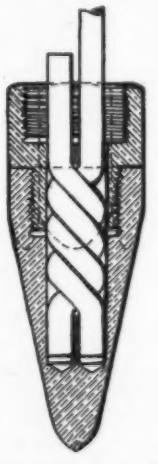


Fig. 3.—Section of Type B Ground Point.

Another form of the Fargo ground point, known as the type B, employs a different principle for making an effective connection. In external appearance it resembles the type A de-

vice shown complete at the right in Fig. 1. The internal arrangement is shown in the cross-sectional view, Fig. 3. In this case two wire ends are placed side by side and tightly twisted together. The twisted part is then put into the ground point with the two wire ends fitting into the two pockets provided for this purpose. On screwing down the nut a tight clamping connection is obtained. In other respects this ground point is like that illustrated in Figs. 1 and 2.

Electrostatic Potential and Synchronism Indicators.

Electrostatic vacuum glowers are now being used to indicate the presence of potential on high-voltage alternating-current circuits, and to determine when such circuits are in synchronism and may be thrown together.

For indicating potential, the two appliances shown in Figs. 1 and 2 have been developed by the General Electric Company. The first consists of an electrostatic glower, a metallic condenser hood, a switch for cutting the glower in and out of circuit, and a hook for suspending the indicator from the line and leading current to the glower. One terminal of the glower is connected to a spark gap and then to the lower end of the suspension hook; the other terminal is connected to the condenser hood. The loop in the suspension hook enables the indicator to be hung over the line by means of the ordinary type of switch hook used for operating disconnecting knife switches.

The indicator switch when closed provides a low-resistance path between the line and the hood, and cuts the glower out of circuit. When the switch is open, the glower is connected between the line and hood through the spark gap, and will light up if there is potential on the line at least equal to the tension between the line and ground on a three-phase system carrying 15,000 volts. This indicator is used for indoor and outdoor service and, as a rule, hangs on the line continually, but, of course, can be moved about as desired. Usually a grounded wire is connected to the switch string sufficiently close to the hood to be out of reach of the operator.

The second form of indicator, shown in Fig. 2, is essentially the same as just described, except that no switch is provided and the hood is attached to a long wood rod equipped with a ground cone for connecting a wire between the rod and ground. The upper terminus of the lead running down to the spark gap inside the hood is connected to another lead going to the top of the pole to a metal pin, which is held against the line to determine whether the line is alive. This indicator is, because of its easy portability, most suitable when the indication of potential may be desired on a number of lines.

In using an electrostatic indicator, one should always bear in mind the fact that, although the lighting of the glower gives a positive assurance of voltage on the line, the lack of glow does not by any means prove the line to be dead, because the bulb may be broken, the leads disengaged, the potential too low, etc.

The usual method of indicating when alternating-current lines or machines may be thrown together is by the use of a synchronism indicator and synchronizing lamps, or by either the indicator or lamps separately, employing also as a rule the potential transformers that are used in conjunction with the meters or instruments. This arrangement is entirely satisfactory; but when it is desired to connect systems together where transformers are not needed for indicating or measuring purposes, the equipment is comparatively expensive. The higher the voltage, the more does this apply.

The electrostatic synchronizer, made by the General Electric Company, and shown in Fig. 3, requires for operation only the charging current of the line. It consists of a few simple and inexpensive parts, and can be used to considerable advantage in main stations where current is metered on the low side, in switching stations, line-junction stations and some substations.

Three electrostatic glowers, mounted in a case, which resembles that used for a round-pattern switchboard instrument, are used for each synchronizer. The glowers are connected to the line through condensers consisting of suspension insulators, the insulating value of which is at least equal to that used for insulating the line.

To use the synchronizer, the terminals of one of the glowers are connected through the insulators to the leads of the same phase of running and incoming lines. The other glowers are each connected across dissimilar

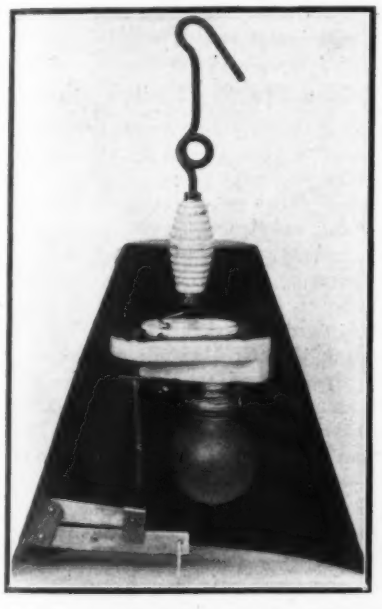


Fig. 1.—Electrostatic Potential Indicator.

Fig. 2.

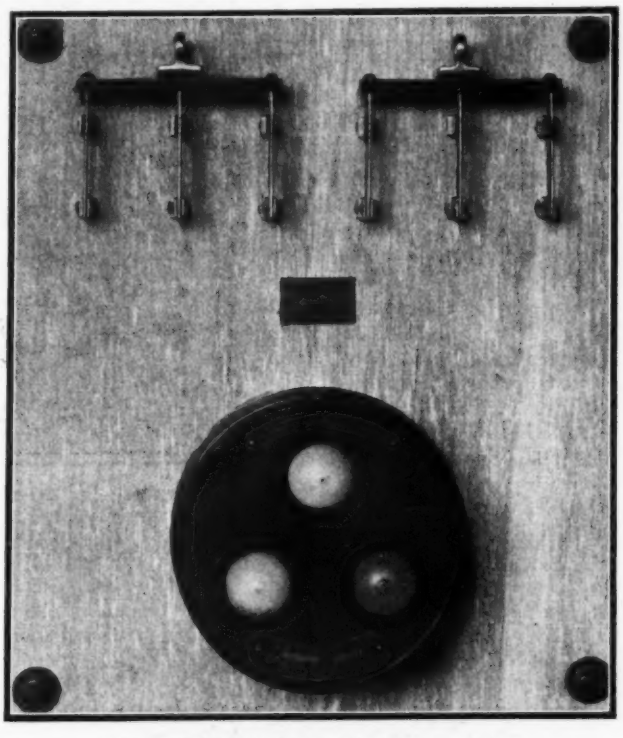


Fig. 3.—Electrostatic Synchronism Indicator.

phases of the remaining leads of the running and incoming lines.

When the lines are not in synchronism, the glowers will indicate the relative frequency of the lines in the same manner as the usual synchronizing lamps. When in synchronism, the rotating effect will disappear, the glower connected to the corresponding lines will be dark and the other two will show about one-half brilliancy. The minimum voltage for operation is 13,200, and the maximum depends only on the use of the proper number of insulators.

The synchronism indicator can be used as a ground detector by connecting one terminal of each glower to ground and the other terminals to the line. A lighted glower will indicate that the line is at potential above ground, that is, not grounded.

Cordless Vestibule Telephone Outfit for Apartment Buildings.

The Connecticut Telephone & Electric Company, Meriden, Conn., has just placed on the market a new vestibule telephone outfit. This is known as the cordless type. As will be noted from the accompanying illustration, this telephone has a concealed transmitter and receiver mounted behind perforated sound openings in the face plate.

To operate it, it is simply necessary to push the button and talk facing the vestibule telephone just as if in conversation with any party standing directly in front. The person talking from the suite can be heard for a long distance from the vestibule telephone, due to a specially constructed loud-talking receiver. There is nothing on the face plate except the card holders and buttons. Therefore there are no cords or receivers to be stolen, nor hooks to be broken. The perforated sound openings on the front of the plate are protected by a bugproof brass screen.

Cordless Vestibule Telephone with Mail Boxes.

It is the opinion of the makers and of others who have seen it, that this outfit will revolutionize vestibule telephone sets. It is entirely new and nothing of its kind has been heretofore placed on the market. The outfit is compact and neat in appearance. The absence of the cord and hanging receiver eliminates trouble. Use of the new set, while very novel, is found less confusing and much more convenient than the use of most vestibule telephone sets. These outfits are made up for practically any size of apartment building and afford means for communicating with the janitor, as well as any suite.

Copper Fittings for Heavy Cable Connections.

In wiring power houses, substations, power and lighting switchboards, heavy electrical machinery and all circuits, in fact, where large currents are carried by heavy cables or other conductors, great care is necessary in making connections between these conductors and the busbars or other terminals on the switchboards and machinery in order to insure abundant carrying capacity and the avoidance of losses at the connections. This is not only to insure efficiency in the wiring, but more important still, to secure reliability of contact. Improper connections mean high resistance and decided heating, which may result in melting of soldered cable lugs and opening of the circuit, if not more serious troubles.

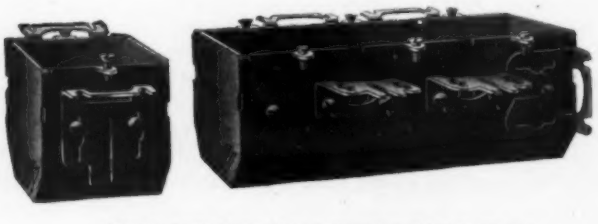
New Copper Fittings.

To insure proper connections requires a variety of high-grade copper fittings designed with regard to the varied requirements of busbar, cable and special-conductor connections under different conditions. This matter has been given careful consideration by the Electrical Engineers' Equipment Company, which has put on the market a complete line of high-conductivity cast-copper fittings, including a variety of plain and angle-type cable lugs, clamp-type terminals, laminated leaf and split-tee connectors, connecting sleeves, screw connectors, switch lugs, "shrink-fit" fittings, etc. All the fittings are designed to meet as far as possible standard requirements as to size and shape. Special fittings are made up quickly according to specifications.

The Electrical Engineers' Equipment Company, 711-15 Meridian Street, Chicago, Ill., has just issued bulletin No. 105, wherein these fittings are fully described. This bulletin is handsomely printed and the illustration herewith is a reproduction of the cover, which is printed in colors.

Wurdack Spacing Switch Boxes.

During the last few years much ingenuity has been shown by the manufacturers in developing switch boxes to meet the varied requirements of electrical construction. One of the most unique types of switch boxes, incorporating in its design several valuable ideas, has recently been placed on the market by the William Wurdack Electric Manufacturing Company, St. Louis, Mo. These boxes are made for loom construction and have the uniform depth of 2.25 inches. The distinctive feature about them is that each box is readily adaptable for a variety of purposes and can be easily assembled with other boxes into a gang of any number of units. The illustrations show the principal features. In order to adapt the single box for assembly into a gang, such as shown on the right, either or both sides of each box can be readily removed. In order to remove the side or sides, the box is held upside down and the bottom end of the side to be removed is struck at the point indicated on all boxes by the stamp "To Open—Hit Here." The units in the middle of the gang of three or more boxes have both sides removed and when placed side by side they are easily connected together.



Single and Three-Gang Spacing Switch Boxes.

The ears are practically universal in adaptability and as shown in the illustrations can be used for four or more different conditions. For example, in the view of the single box the ear on the back of the box is shown raised, as would be necessary in old work. The ear on the front of the box is shown lowered as a short ear for new work. Likewise, in the view of the three-gang box the ears on the back are shown raised for old work. In this view the two middle ears at the front of the back are shown with their short sides used as bridging ears to gang the units together; this allows the long ears to project from the boxes for new work. At the right end of this cut one ear is shown turned at right angles as a side ear for end support.

The illustration of the gang box shows that by the removal of the intervening sides a continuous box with maximum room for alining of switches or wall receptacles is produced. No spacers are needed in ganging the boxes. To change the ears from one position to another requires but a moment's time. The use of these boxes eliminates the need of carrying a large stock of varied types of boxes on hand, since each box in stock can be readily adjusted to any other type as the condition may require. The boxes may be taken to the job without being previously specially ordered for particular conditions.

Automatic Switch for Lighting Plants.

The Hartman Electrical Manufacturing Company, Mansfield, O., has brought out a new automatic switch for isolated lighting-plant switchboards, suitable for the largest systems now in use. The switch has a capacity of 100 amperes and is made for 32, 65 and 110-volt systems. This automatic switch, or cut-in and cut-out switch, as it is often called, renders unnecessary all hand manipulation of the switch on small plant boards. It automatically cuts in or connects the generator with line whenever the voltage is high enough to charge the battery and in the same way it automatically cuts out on reversal of current. In the construction of the contacts, a laminated brush is used for the main contact and this is protected by an auxiliary or arcing contact. These contacts are mounted directly on the moving core or armature and as long as the generator voltage exceeds the battery voltage they are held firmly in contact with the stationary blocks.

Automatic Lighting Switch.

Adjustment for the exact cut-in and cut-out voltage is made by means of a weight attached to the lower end of the solenoid core, and this weight also serves to open the contacts with a quick break when the reverse flow takes place. The contact blocks are integral with the studs and the latter serve the double purpose of carrying the current and affording means of mounting the switch on the panel.

Large-Capacity Outdoor Substations for Industrial Service.

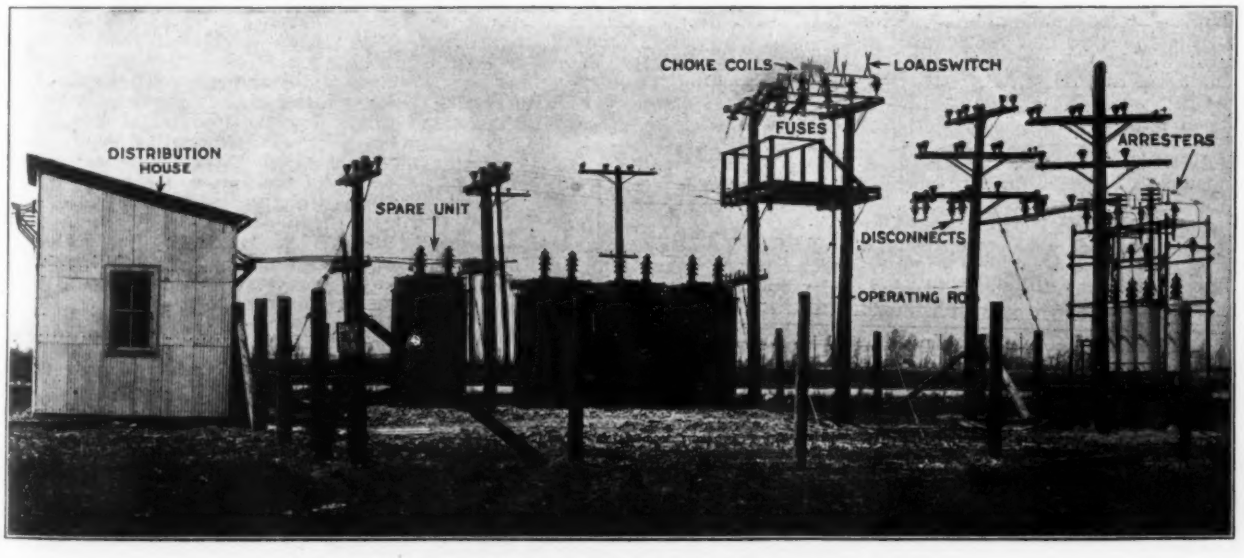
The increasing use of high-capacity outdoor-substation equipment is well illustrated by the installation shown herewith, which supplies industrial loads from a transmission feeder.

The transformers are of 500-kilovolt-ampere capacity each, stepping down from 33,000 to 2,300 volts, the secondary lines being run in the usual manner to various consumers. A spare transformer forms part of the installation and can be quickly connected.

High-tension control equipment consists of a standard three-pole air-break switch, three choke coils and three 15-ampere chemical fuses. The lightning-arrester installation is equipped with three single-pole underhung disconnects, by means of which the arresters can be cut out of service.

The secondary circuits are controlled by oil switches, mounted in the distribution house, from which the industrial lines are carried. By means of a permanently grounded operating handle the 33,000-volt air-break switch can be controlled, the fuses being easily reached from the platform, after the main switch is opened.

The air-break switch, choke coils, fuses and disconnects are of the standard form manufactured by the Delta-Star Electric Company, Chicago, Ill., the electrolytic arresters being of General Electric manufacture and the transformers of Westinghouse make.



Outdoor Substation, 33,000 Volts, 1,500 Kilovolt-Amperes, 60 Cycles.

Latest Approved Fittings

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

CABINETS.—Columbia Metal Box Company, 226 East 144th Street, New York, N. Y.

Sheet metal cabinets for meters and meter protective devices.

Listed July 13, 1915.

CONDUIT OUTLET BUSHINGS.—The Sterling Foundry & Machine Company, 55 Hartford Street, Newark, N. J.

"Sterling" armored cable connector for use with standard outlet boxes with knockouts for one-half-inch conduit and consisting of a cast-iron sleeve with a thread and locknut for attaching to the box, and a clamping screw for securing the cable.

Listed July 6, 1915.

CONDUIT OUTLET PLATES.—The Sterling Foundry & Machine Company, 55 Hartford Street, Newark, N. J.

Cast-iron outlet plates for combination gas and electric and straight electric outlets.

Sterling "Bi-Plex" plates with clamps for armored cable.

Listed July 7, 1915.

FITTINGS FOR CONDUIT BOXES—COVERS.—Steel City Electric Company, 1207 Columbus Avenue, Pittsburgh, Pa.

Stamped steel conduit boxes with single metal-bushed hole for pendant of reinforced flexible cord.

Catalog Nos. AD, AF, BD, BF, CD, CF.

Listed May 24, 1915.

FIXTURES.—Harvey Deschere & Company, 1507 Garden Street, Hoboken, N. J.

Argus miniature electric sign. One or more sections, each comprising a base or tray and a number of interchangeable letters with miniature lamps and shunt resistances. An attachment plug, and either portable or armored cord are provided for connection to the lighting circuit. 125 volts.

Standard for indoor use only.

Listed July 10, 1915.

FUSELESS ATTACHMENT PLUGS.—The Arrow Electric Company, 103 Hawthorne Street, Hartford, Conn.

Non-separable attachment plugs.

Arrow E.

660 watts, 250 volts, catalog No. 1948.

660 watts, 600 volts, catalog No. 345.

Listed July 10, 1915.

FUSES, Cartridge Inclosed.—Electric Fuseguard Company, Incorporated, 391 Mulberry Street, Newark, N. J.

"Fuseguard" cartridge inclosed fuses.

0-200 amperes, 250 volts; 0-100 amperes, 600 volts.

Listed July 10, 1915.

RECEPTACLES, Candelabra and Miniature.—The Arrow Electric Company, Hartford, Conn.

Arrow E, 75 watts, 125 volts.

Candelabra.

Sign, catalog No. 390.

Cleat, catalog No. 367.

Miniature, for decorative lighting systems, Christmas-tree lighting outfits and similar purposes. For indoor use only.

Sign, catalog No. 389.

Cleat, catalog No. 366.

Listed July 10, 1915.

RECEPTACLES, Standard.—The Arrow Electric Company, 103 Hawthorne Street, Hartford, Conn.

Metal-shell receptacles, Arrow E.

Key, 250 watts, 250 volts, catalog Nos. 8058, 50717-18, 60430.

Key, 660 watts, 250 volts, catalog Nos. 8058W, 60430W.

Keyless, 660 watts, 250 volts, catalog Nos. 8059, 60431.

Pull, 250 watts, 250 volts, catalog Nos. 156, 8514-20-21. For use on metal ceilings, catalog No. 108.

Also all of above types with shadeholders attached, key types with composition or insulated metal key, pull types with extension attachment, medium types with "Arrolock" attachment.

Listed July 10, 1915.

RECEPTACLES, Standard.—Benjamin Electric Manufacturing Company, 120 South Sangamon Street, Chicago, Ill.

Benjamin, keyless, porcelain-shell.

660 watts, 250 volts.

Conduit box, catalog Nos. 1402-03, 1405-06, 1410-11.

Listed July 6, 1915.

RECEPTACLES, Weatherproof.—The Arrow Electric Company, 103 Hawthorne Street, Hartford, Conn.

Arrow E.

660 watts, 600 volts, for use with incandescent lamps in series on 600-volt circuits, catalog Nos. 4003, 9301-6, inclusive, 9407-08-11, 44912, 61577-8.

Listed July 12, 1915.

ROSETTES, Fuseless. — Harvey Hubbell, Incorporated, Bridgeport, Conn.

Hubbell, 3 amperes, 125 volts, 1 ampere, 250 volts.

Ceiling pull-switch rosettes.

Concealed, catalog No. 6018.

Molding, catalog No. 6017.

Conduit box, catalog Nos. 6019 and 6035.

Listed July 7, 1915.

SIGNS, Electric.—P. J. Martin, Incorporated, 302 West Fifty-third Street, New York, N. Y.

Electric signs shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters have labels attached.

Listed July 2, 1915.

SOCKETS, Candelabra and Miniature.—The Arrow Electric Company, 103 Hawthorne Street, Hartford, Conn.

Arrow E, 75 watts, 125 volts.

Candelabra.

Keyless, brass-shell, catalog No. 321. Porcelain, catalog No. 323.

Pull, brass-shell, catalog No. 386.

Miniature.

Keyless, brass-shell, catalog No. 320. Porcelain, catalog No. 322. For candle fixtures, catalog Nos. 327, 346.

Pull, brass-shell, catalog No. 385.

Listed July 12, 1915.

SOCKETS, Standard.—The Arrow Electric Company, 103 Hawthorne Street, Hartford, Conn.

Arrow E brass-shell electrolier sockets.

Key, 250 watts, 250 volts, catalog No. 7076.

Keyless, 660 watts, 250 volts, catalog Nos. 7077, 7078.

Pull, 250 watts, 250 volts, catalog No. 7079.

Also all of above types with shadeholders attached, key types with composition or insulated metal key, pull types with extension attachment, medium types with "Arrolock" attachment.

Standard for fixture use only.

Listed July 12, 1915.

SOCKETS, Standard.—Benjamin Electric Manufacturing Company, 120 South Sangamon Street, Chicago, Ill.

Benjamin brass-shell.

Pull, 660 watts, 250 volts, catalog Nos. 4207-08.

Listed July 9, 1915.

SOCKETS, Standard.—W. R. Ostrander & Company, 22 Dey Street, New York, N. Y.

Metal-shell, Ostrander.

Key, 250 watts, 250 volts, catalog Nos. 9000-9004, inclusive.

Also above types with shadeholders attached.

Listed July 6, 1915.

SOCKETS, Standard.—Pass & Seymour, Incorporated, Solvay, N. Y.

P. & S. brass-shell sockets.

Key, 250 watts, 250 volts, catalog Nos. 474, 543, 546, 549, 550, 572, 800-804 inclusive, 824-827 inclusive, 7503.

Key, 660 watts, 250 volts, catalog Nos. 600, 606, 612, 614, 616, 624, 626, 628, 650-653 inclusive.

Keyless, 660 watts, 250 volts, catalog Nos. 544, 547, 551, 552 and 574.

Pull, 250 watts, 250 volts, catalog Nos. 507, 545, 548, 553 and 554.

Also above types with shadeholders attached; key types with composition or insulated metal key, pull sockets with extension chain guide or insulating link in chain. Also above types with Shurlok attachment.

P. & S. brass-shell electrolier sockets.

Key, 250 watts, 250 volts, catalog Nos. 446, 494, 495, 496, 508, 512, 555, 560, 564 and 568.

Keyless, 660 watts, 250 volts, catalog Nos. 491, 492, 498, 500, 509, 513, 514, 556, 557, 561, 562, 565, 566, 569, 570, and 575.

Pull, 250 watts, 250 volts, catalog Nos. 499, 510, 515, 559, 563, 567, and 571.

Listed July 8, 1915.

SOCKETS, Weatherproof.—Benjamin Electric Manufacturing Company, 120 South Sangamon Street, Chicago, Ill.

Bracket sockets, including improved type, with two-piece metal shell and two-piece porcelain base. Benco, 660 watts, 600 volts, catalog Nos. 4204, 4205.

Also above types with lamp grip.

Standard for use with incandescent lamps in series on 600-volt circuits.

Listed July 9, 1915.

SWITCHES, Automatic.—E. Rebischung, 79 Wyona Street, Brooklyn, N. Y.

An automatic switch for the control of motors used for tolling large bells. Consisting of an inclosed double-pole carbon-break switch, opened and closed by cams on bell shaft after bell has been set in motion by closing of a main switch in motor circuit; rating 5 amperes, 250 volts.

Standard only when installed as part of special equipment for electrically tolling bells as furnished by this manufacturer.

Listed July 7, 1915.

SWITCHES, Automatic. — Venner Time Switches, Limited, 6 Old Queen Street, Westminster, London, S. W., England.

Mercury-contact switches for control of lighting circuits. Clock mechanisms and special switchgears inclosed in cast-iron cases.

25 amperes, 250 volts. Types C, C-4, C-6, CB, CB-4, CBDC, CDC, C4DC, D6DC.

50 amperes, 250 volts. Type C-50-A.

15 and 5 amperes, 250 volts. Types D, E, DB, DE (two circuits "arc" and "glow").

Listed July 2, 1915.

SWITCHES, Automatic.—Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Remote-control switches, relays and contactors, 1-1250 amperes, 100-600 volts.

Type C, series, shunt and combined series and shunt switches.

Relays, types KC, KA, KF, KS, KT.

Standard for use as parts of control panels, assembled by the manufacturer.

Listed July 7, 1915.

SWITCHES, Automatic. — Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Master switches for industrial control.

Drum type, cam type, mill type, pressure-gauge type, hatchway limit type, geared limit type, motor-operated type, push-button type.

Listed July 8, 1915.

SWITCHES, Push-Button Flush.—The Bryant Electric Company, Bridgeport, Conn.

Byrant or Perkins.

Two-circuit, 2 amperes, 250 volts, 5 amperes, 125 volts, catalog Nos. 2625, 2626, 2628-2630, inclusive.

Three-circuit, 2 amperes, 250 volts, 5 amperes, 125 volts, catalog No. 2627.

Two-speed fan-motor switch, 2 amperes, 250 volts, 5 amperes, 125 volts, catalog No. 2631.

Three-speed fan-motor switch, 2 amperes, 250 volts, 5 amperes, 125 volts, catalog No. 2632.

Listed July 2, 1915.

SWITCHES, Push-Button Flush.—The Hart & Hegeman Manufacturing Company, 342 Capitol Avenue, Hartford, Conn.

Remote-control switch, catalog No. 2883, 10 amperes, 125 volts, 5 amperes, 250 volts.

Listed July 2, 1915.

SWITCHES, Surface Snap.—The Bryant Electric Company, Bridgeport, Conn.

Bryant or Perkins.

Single-pole, 5 amperes, 250 volts, 10 amperes, 125 volts. Type O for suction sweeper mounting.

Listed June 22, 1915.

SWITCHES, Surface Snap.—The Hart & Hegeman Manufacturing Company, 342 Capitol Avenue, Hartford, Conn.

Three-way, 1 ampere, 250 volts. 3 amperes, 125 volts, catalog Nos. 2152, 2153.

3 amperes, 250 volts, 5 amperes, 125 volts, catalog Nos. 2089-2090, 2298-2299, 2545, 2633, 2634.

5 amperes, 250 volts, 10 amperes, 125 volts, catalog Nos. 23, 123, 2209-2210, 2359, 2360.

20 amperes, 250 volts, catalog Nos. 3007, 3008.

1 ampere, 250 volts, catalog Nos. 23½, 123½.

5 amperes, 600 volts, catalog Nos. 53½, 153½, 2425, 2426.

10 amperes, 600 volts, catalog Nos. 2172, 2173, 2515, 2516, 2517-20 inclusive.

Four-way, 2 amperes, 250 volts, 5 amperes, 125 volts, catalog Nos. 24, 124, 2234, 2235.

5 amperes, 250 volts, 10 amperes, 125 volts, catalog Nos. 2959, 2960.

Two-circuit, 2 amperes, 250 volts, 5 amperes, 125 volts, catalog Nos. 29, 129, 229, 329, 429, 529, 629, 729, 2236-39 inclusive, 2246-49 inclusive, 2062-05 inclusive, 2607-10 inclusive, 2611-14 inclusive, 2661-64 inclusive, 2673-76 inclusive, 2721-24 inclusive, 2731-38 inclusive, 2739-42 inclusive, 2743-46 inclusive, 3071, 3072, 3077, 3078, 3101, 3102.

5 amperes, 250 volts, 10 amperes, 125 volts, catalog Nos. 2505-08 inclusive, 2591, 2594-97 inclusive, 2598-2600 inclusive, 2669-72 inclusive.

10 amperes, 250 volts, 15 amperes, 125 volts, catalog Nos. 2482-85 inclusive, 2486-89 inclusive, 2496-99 inclusive.

10 amperes, 250 volts, catalog Nos. 2621-24 inclusive, 3025-28 inclusive.

20 amperes, 250 volts, catalog Nos. 3051-3052.

3 amperes, 600 volts, catalog Nos. 27, 127, 227, 327.

5 amperes, 600 volts, catalog Nos. 57, 157, 257, 357, 2427-30 inclusive.

10 amperes, 600 volts, catalog Nos. 2174-77 inclusive, 2521-24 inclusive.

20 amperes, 600 volts, catalog Nos. 47, 147, 247, 347.

Also above types with lock attachment and with metal or porcelain covers.

Listed June 22, 1915.

SWITCHES, Surface Snap. — The Hart & Hegeman Manufacturing Company, 342 Capitol Avenue, Hartford, Conn.

Three-circuit, 2 amperes, 250 volts, 5 amperes, 125 volts, catalog Nos. 25, 125, 225, 325, 2240-43 inclusive, 2615-18 inclusive, 2747-50 inclusive.

2 amperes, 250 volts, 5 amperes, 125 volts, catalog Nos. 2501-04 inclusive, 2725-28 inclusive.

Series, multiple and series-multiple.

Single-pole, 5 amperes, 250 volts, 10 amperes, 125 volts, catalog Nos. 2578, 2592, 3019, 3020.

2 amperes, 250 volts, 5 amperes, 125 volts, catalog Nos. 2305 and 2720.

10 amperes, 250 volts, catalog Nos. 2813, 2814, 2981, 2982.

20 amperes, 250 volts, catalog Nos. 2199, 2200.

10 amperes, 600 volts, catalog Nos. 2193-96 inclusive.

15 amperes, 600 volts, catalog Nos. 799, 800.

35 amperes, 600 volts, catalog No. 162.

Double-pole, 10 amperes, 250 volts, catalog Nos. 2160, 2860, 2861.

20 amperes, 250 volts, catalog Nos. 160, 2761-63 inclusive.

35 amperes, 250 volts, catalog Nos. 2582, 2587, 2764, 2765.

Also above types with lock attachment and with metal or porcelain covers.

Listed June 23, 1915.

SWITCHES, Surface Snap. — The Hart & Hegeman Manufacturing Company, 342 Capitol Avenue, Hartford, Conn.

Single-pole, catalog Nos. 20, 21, 50½, 120, 121, 150½, 220, 221, 241½, 250½, 320, 321, 341½, 350½, 441½, 541½, 2148, 2161-67 inclusive, 2199-2200, 2205, 2206, 2231, 2232, 2291, 2292, 2305, 2308, 2309, 2351-54 inclusive, 2391, 2392, 2421-24 inclusive, 2511-14 inclusive, 2541, 2542, 2578, 2592, 2625-28 inclusive, 2654, 2684, 2720, 2813, 2814, 2981-86 inclusive, 3019, 3020, 3149, 3150.

Double-pole, catalog Nos. 22, 32, 42, 122, 132, 142, 160, 222, 322, 432, 442, 532, 542, 2074, 2085-88 inclusive, 2160, 2168-71 inclusive, 2207, 2208, 2219, 2244, 2245, 2296, 2297, 2306, 2321, 2355-58 inclusive, 2396, 2397, 2517-20 inclusive, 2543, 2544, 2582, 2587, 2621-24 inclusive, 2629-32 inclusive, 2761-65 inclusive, 2857, 2860, 2861, 2955, 2956, 2958, 3015-18 inclusive, 3025-28 inclusive, 3048, 3064, 3065.

Triple-pole, catalog Nos. 26, 126, 226, 326, 2655-58 inclusive.

Three-way, catalog Nos. 23, 123, 2089, 2090, 2152, 2153, 2209, 2210, 2298, 2299, 2359, 2360, 2398, 2545, 2633, 2634.

Four-way, catalog Nos. 24, 124, 2234, 2235, 2959, 2960.

Two-circuit, catalog Nos. 29, 57, 129, 157, 229, 257, 329, 357, 429, 529, 629, 729, 2236-39 inclusive 2246-49 inclusive, 2427-30 inclusive, 2482-89 inclusive, 2496-99 inclusive, 2505-08 inclusive, 2591, 2594-2600 inclusive, 2602-05 inclusive, 2607-14 inclusive, 2661-64 inclusive, 2669-76 inclusive, 2721-24 inclusive, 2731-46 inclusive, 3071, 3072, 3077, 3078, 3101, 3102.

Three-circuit, catalog Nos. 25, 125, 225, 325, 2240-43 inclusive, 2501-04 inclusive, 2615-18 inclusive, 2725-28 inclusive, 2747-50 inclusive.

Also above types with lock attachment, with or without indicating dials, and with metal or porcelain covers.

Listed June 25, 1915.

Current Electrical News

ATLANTIC STATES.

WESTFIELD, MASS.—This town has voted to expend $25,000 for improvements on its municipal light plant; $11,500 will be used for overhead cables and extensions and $3,500 for cables for the Elm Street conduit.

FREDONIA, N. Y.—A new system of electric lighting is proposed. Address town clerk.

HORNELL, N. Y.—A proposition will be voted on by the citizens of Canisteo to secure electrical energy from the Hornell Electric Company.

LESTERSHIRE, N. Y.—The power plant operated by Endicott, Johnson & Company will be doubled in capacity by the equipment of a 2,000-kilowatt steam turbine and auxiliary apparatus.

NORTH CENTRAL STATES.

AKRON, O.—The Firestone Tire and Rubber Company will install equipment to furnish its own electric lights and power.

CINCINNATI, O.—An ice plant, with a capacity of 75 tons a day and costing $75,000, is to be built in Price Hill, a suburb, by the City Ice Delivery Company. Plans and specifications are being prepared by Bernard Wisenall, architect, of Cincinnati. Estimates will be called for in a short time. L.

CISSNA PARK, ILL.—Money is being raised to install cluster lights. Address town clerk.

POPLAR GROVE, ILL.—The electric plant and grist mill owned by Warrent M. Webster burned. Loss $10,000.

GRAND RAPIDS, MICH.—The Division Center Improvement Association, which is raising $12,000 toward the cost of boulevard lighting from Wealthy Street to Hall Street, has decided, if the city authorities give consent, to install the solid iron post, one-light system. Address city clerk.

STEPHENSON, MICH.—The sum of $5,000 in bonds has been voted to install a light and power plant. Address town clerk.

ELLENDALE, MINN.—Ways and means are being discussed for an electric light plant. Address town clerk.

FAIRMONT, MINN.—The Water and Light Commission plans to purchase about 100 lamp standards for ornamental lights. Address Alfred Horne, superintendent.

HARDWICK, MINN.—The sum of $5,000 in bonds has been voted for remodeling the village power plant. Address town clerk.

MANKATO, MINN.—The Consumers Power Company is negotiating a contract to furnish light and power to the city of St. James.

COLUMBUS JUNCTION, IOWA.—It has been planned to install an ornamental lighting system of about 20 posts of three and five lights. Address W. H. Jennings.

NORTH ENGLISH, IOWA.—The Iowa Electric Company has been granted a franchise in North English. The transmission line will be extended from Williamsburg to Parnell. The line is to be completed within 90 days from the acceptance of the franchise of the company.

RIVERTON, IOWA.—The electric light franchise proposition was carried. The Hamburg Electric Light Company has started the construction of a transmission line, and it is believed the lights will be in use here by fall.

WHITE EARTH, N. D.—The council is planning ways and means to establish a municipal light plant. Address mayor.

NETAWAKA, KANS.—$10,000 will be expended for municipal lighting. Address city clerk.

SOUTH CENTRAL STATES.

HAZARD, KY.—Plans are now being perfected for a very extensive central electric plant in this city, which will furnish power to all the mines in this district. Address J. A. Roan.

PARIS, KY.—Electric elevators and other equipment will be installed in a big tobacco handling plant which is to be erected by Lexington and Paris business men. A site has been purchased from J. T. Flora, J. H. Stivers and J. W. Bacon.

CHATTANOOGA, TENN.—The Public Light and Power Company is the name chosen by the Adams interests for the merged Tennessee Valley Light and Power Company, the Dayton, Tenn., Light and Power Company and several other similar corporations in lower east and middle Tennessee towns. The properties are operated by J. W. and G. B. Adams and associates, and the various circuits at Bridgeport, South Pittsburgh, Shelbyville, Dayton and Rockwood are supplied by local steam plants, as well as by connections with the hydroelectric plants at Hale's Bar and Ocoee. Headquarters of the Public Light and Power Company are at 809 Georgia Avenue, Chattanooga.

JELLICO, TENN.—The town is considering a project for the construction of a municipal electric plant at a cost of $25,000, for street and commercial lighting, and a white-way system, with 100 standards, to carry from two to four lamps, at an estimated cost of $10,000. F. C. Moore is chairman of the committee which has the plans in hand.

DALLAS, TEX.—The commissioners' court will purchase a 200-kilowatt engine and generator as additional equipment for the county power plant.

HOLLAND, TEX.—The City Council has entered into a contract with the Texas Power and Light Company, of Dallas, for the construction of an electric lighting system here. D.

WESTERN STATES.

ANACONDA, MONT.—Resolutions for creating Improvement Districts No. 66 and 69, for ornamental street lighting systems, costing, respectively, $39,000 and $4,000, have been passed by City Council. O.

BOZEMAN, MONT.—Special Improvement District No. 100, for installation of lighting system on Main Street, between Ida and Fourth Avenues, has passed City Council. O.

DEER LODGE, MONT.—Plans for the division of the city into 11 improvement districts, to install and operate a system of electric lights in the residence portion, are being considered by the City Council. The arrangement will be similar to the one now in use on the business streets of the city. O.

POLSON, MONT.—The installation of a modern electric lighting system is in contemplation by the City Council. At a recent election the voters authorized bonds to cover construction. O.

ROUNDUP, MONT.—Resolution for creating Special Improvement District No. 12, covering a system of ornamental street lighting estimated to cost $13,000, has passed the City Council. P. A. Appleman, city clerk. O.

PROVO, UTAH.—The city engineer has been instructed to prepare plans for the new electric power and light plant for Provo.

MISSION CITY, B. C.—The Board of Trade is negotiating with the Provincial Government looking toward the installation of a municipally owned and operated street lighting system. Recently, a committee consisting of A. M. Vechere, A. A. Lane and A. Stevens was appointed to confer with the Government regarding the installation, and it is thought it will be but a short time before the installation will be made.

REPUBLIC, WASH.—The Ferry County Commissioners, W. V. O'Connell, Auditor, have been petitioned for franchises for furnishing light and power and for constructing power transmission lines in Ferry County. Address both F. R. Clark and George S. Bailey. O.

VASHON, WASH.—The Vashon-Maury Light and Power Company, G. A. Collins, L. C. Smith Building, Seattle, president, recently announced that extensions of transmission lines would be made between Dockton and the west side of the Islands in the immediate future; also that current would be ready for delivery to customers between Glen Acres and Burton about September first. This company, to date, has expended about $30,000 in developing a power plant and extending its lines on Vashon and Maury Islands. O.

ASHLAND, ORE.—Negotiations for the purchase by the city of the plant and distributing system operated in Ashland by the California-Oregon Elec-

tric Light and Power Company, have been entered into. The city has operated a municipal plant for several years, which has been extremely successful, but which is not large enough at present to supply the city's needs. The proposed deal contains arrangements for rescinding the company's franchise and terminating the suit.

GRANTS PASS, ORE.—At a recent election a franchise was granted the Rouge River Public Service Corporation for the installation of an electric light and power system within the city, service to be guaranteed within nine months.

MERCED, CAL.—The council is planning municipal ownership of the electric plant. Address City Attorney Henderson.

PASADENA, CAL.—An election will be called this month to pass on a plan of ornamental street lighting to cover about 18 miles of streets.

QUINCY, CAL.—The Board of Supervisors has granted the Great Western Power Company permission to proceed with the construction of a pole line from Big Meadows to the Engels copper mine in Lights Canyon, a distance of 35 miles.

SAN BERNARDINO, CAL.—Property owners on Third Street have petitioned the City Council for the installation of an ornamental lighting system on that street.

PROPOSALS.

EQUIPMENT. — The State Board of Insanity will receive bids for electric work in the construction of a brick dormitory, a wooden building for employees and a farmer's cottage at Wrentham, Mass. Plans on file at Kendall, Taylor & Company, architects, Boston, and bids must be delivered at the office of the Board, State House, Boston, before August 10, 12 o'clock noon.

NAVY ELECTRICAL SUPPLIES.—Sealed proposals will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until August 16, 1915, for furnishing the following materials. Firms interested therein should make application to the Bureau of Supplies and Accounts, giving the schedule numbers desired: Schedule 8625, interior communication cable, bell wire, double-conductor wire, single-conductor wire, twin-conductor wire. Bids will be opened on September 7, 1915, for the following materials: Schedule 8615, subway-type fuse boxes, one and three-conductor cable, duct fiber, integrating watt-hour meter, subway-type transformer.

LIGHTING FIXTURE.—Sealed bids will be received at the supervising architect's office, Treasury Department, Washington, D. C., until August 18, for furnishing and installing lighting fixtures in the United States postoffice at Berkeley, Cal., and the United States postoffice at Denver, Colo., in accordance with drawings and specifications, copies of which may be had at the office of the supervising architect.

INTERIOR LIGHTING FIXTURES.—Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until September 10, for interior lighting fixtures for the United States postoffice at Gouverneur, N. Y. Drawings and specifications may be obtained from the custodian of site at Gouverneur, N. Y., or at the office of the supervising architect.

FOREIGN TRADE OPPORTUNITIES.

[Addresses may be obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch offices at Boston, New York, Atlanta, Chicago, St. Louis, New Orleans, Seattle and San Francisco. Write on separate sheet for each item and give file number.]

NO. 17,593. INSULATING MATERIAL.—The Bureau of Foreign and Domestic Commerce is in receipt of a letter from a merchant in Spain stating that he desires to receive offers for rubber sleeves for covering copper wire similar to the sample which may be examined at the Bureau or its branch offices.

NO. 17,646. GLASS BULBS AND BRASS CAPS.—An American consular officer in England writes that an electrical supply dealer in his district is desirous of purchasing glass bulbs for incandescent lamps, complete with chemical filling. A sample of the brass cap, together with designs of the bulbs, may be examined at the Bureau of Foreign and Domestic Commerce or its branch offices.

NEW INCORPORATIONS.

NEW YORK, N. Y.—Hartwick Seminary Lighting Company. Inc. Electric lighting business. Capital, $2,000. Incorporators: J. G. Travers, Lee Kinne and Henry C. Swartout, Hartwick Seminary, N. Y.

AUSTIN, TEX.—Mission Ice, Light and Water Company, Mission. Capital $20,000. Incorporators J. A. Sadler, J. L. Jones, J. P. McEvoy.

NEW YORK, N. Y.—City Electric Service Company, Inc. Electrical supplies, etc. Capital, $1,000. Incorporators: Charles Hirsch, Lee Goldsmith and Samuel E. Bleyer, New York City.

LOCKHART, TEX.—The Citizens' Water Works, Electric Light and Ice Company has been organized here with a capital stock of $100,000. It will build an electric light and power plant. E. B. Coopwood is interested. D.

NEW YORK, N. Y.—New York Switch and Panel-Board Company, Inc. Electrical goods. Capital, $25,000. Incorporators: J. Walter Smith, Fred'k Weierman, New York City, and J. F. P. Young, Maspeth, L. I.

NEW YORK, N. Y.—Robert E. Denike, Inc. Electrical contractors, etc. Capital, $5,000. Incorporators: Robert E. Denike, Summit, N. J.; Charles A. Francke, Yonkers, N. Y.; Henry R. Herke, Bronx, N. Y.

NEW YORK, N. Y.—United States Cutting Machine Sales Company, Inc. Manufacturer electric cloth-cutting machines, etc. Capital, $10,000. Incorporators: Morris I. Garshelis, Bronx, N. Y.; Samuel Philips, Bronx, N. Y., Nicholas Komow, Brooklyn, N. Y.

FINANCIAL NOTES.

The reorganization plan of the Kansas City Railway & Light Company provides for a new company for the railway system and a new company for the lighting. The old funded securities are to get par in new issues and will, in a great measure, maintain their status. There will be issued $1,000,000 first 5s, due 1944, on the railway, and a similar amount on the lighting company. The money from these issues is to provide for immediate needs. There are other issues provided in Judge Hook's plan, but the details will not be announced at present, but will have to wait approval of New York interests.

Marconi's Wireless Telegraph Company, Limited, made a net profit of $1,163,582 during 1914, an increase of $551,960, but this is without reckoning anything in respect of services rendered to the British government during the war. The government has had the use of the company's high-power stations, but as the basis of remuneration is not yet settled, whatever income may accrue from that source will benefit later balance sheets. Owing to dislocation of affairs and the deferring of business of importance which was at point of fruition, as well as the abandonment of promising negotiations with foreign governments, and the postponing of the direct public telegraph services between England and the United States and Spain, only ten per cent dividend is to be paid on the ordinary shares, and only seven per cent on the preferred shares. These are big decreases compared with the distributions in the previous year, notwithstanding the above increase is net profit. A conservative policy has been adopted, a further $500,000 being put to reserve, bringing it up to $4,837,650, and $347,485 is being carried forward to 1915.

The French Company (Compagnie Française Maritime et Coloniale de Telegraphie sans Fil) has paid ten per cent on its ordinary shares for 1914, and 31.25 francs per share on its founders' shares.

The Russian companv (Société Russe de Télégraphes et Téléphones sans Fil) has made satisfactory progress, paying 15 per cent dividend for 1914, as compared with only six per cent for 1913.

Dividends.

	Term.	Rate.	Payable.
Chicago Rys.	S	4 %	Sept. 1
Mobile Elec. pf.	Q	1.75%	Aug. 15
Nev.-Cal. Elec. pf.	S	2 %	Aug. 10
J. G. White, Inc., pf.	Q	1.5 %	Sept. 1
J. G. White Eng., pf.	Q	1.75%	Sept. 1
J. G. White Mtg., pf.	Q	1.75%	Sept. 1

Reports of Earnings.

COLUMBUS RAILWAY, POWER & LIGHT.

	1915	1914
June gross	$ 244,059	$ 249,684
Net	93,809	79,733
Surplus	54,468	40,786
Twelve months' gross	3,059,929	3,056,760
Net	1,233,286	1,083,451
Surplus	764,917	597,200

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Aug. 2.	July 26.
American Tel. and Tel. (New York)	121½	121½
Commonwealth Edison (Chicago)	134½	132½
Edison Electric Illuminating (Boston)	235	234
Electric Storage Battery common (Philadelphia)	53	52
Electric Storage Battery preferred (Philadelphia)	53	52
General Electric (New York)	171¼	175⅛
Kings County Electric (New York)	119	119
Massachusetts Electric common (Boston)	5	5
Massachusetts Electric Preferred (Boston)	34	33
National Carbon common (Chicago)	134	135
National Carbon preferred (Chicago)	120	—
New England Telephone (Boston)	131	131
Philadelphia Electric (Philadelphia)	23¼	23⅝
Postal Telegraph and Cables common (New York)	74	75½
Postal Telegraph and Cables preferred (New York)	65	64
Western Union (New York)	68½	68
Westinghouse common (New York)	101¼	106⅝
Westinghouse preferred (New York)	130	122

MONTANA POWER.

The report of the Montana Power Company for the quarter and six months ended June 30, 1915, compares as follows:

Quarter ended June 30:

	1915	1914
Gross earnings	$ 976,432	$ 965,693
Net after taxes	693,148	687,839
Surplus after charges	399,662	405,211

Six months ended June 30:

	1915	1914
Gross earnings	$1,910,207	$1,923,785
Net after taxes	1,345,195	1,365,644
Surplus after charges	789,278	817,364

PERSONAL MENTION.

MR. C. C. CURTIS, Houghton, Mich., has been appointed lighting superintendent of the El Paso Electric Railway Company, El Paso, Tex. He succeeds L. W. Pritchett, who will go to California for the benefit of his health.

MR. WILLIAM LINCOLN SMITH, secretary of the National Association of Electrical Inspectors, is spending the summer at his bungalow on the Penobscot River, Maine. Mr. Smith reports landing a 14-pound salmon upon a recent expedition with rod and fly.

MR. THOMAS L. BARNES, for the past three years eastern sales manager of the insulated wire department of B. F. Goodrich Company, Akron, O., has been made sales manager of the insulated wire department with headquarters in Akron, succeeding Mr. R. K. Sheppard.

DR. A. S. McALLISTER has resigned as editor of the *Electrical World*, of New York. Dr. McAllister received his preliminary education in the public schools of Covington, Va., and received his degrees of B.S. and E.E. from Pennsylvania State College. His early business career was in connection with the Covington Machine Company, the Berwind-White Coal Company and in the factory of the Westinghouse Electric & Manufacturing Company. He received the degree of M.M.E. after a post-graduate course at Cornell University, and later on the degree of Ph.D. During 1901 to 1904 he was assistant and instructor in physics and applied electricity at Cornell, and was acting assistant professor of electrical engineering there in 1904. He became associate editor of the *Electrical World* in 1905, and since 1912 was editor of that publication. Dr. McAllister has contributed many noteworthy articles and treatises to contemporary scientific literature, and has secured patents for a number of electrical inventions. He is the author of "Alternating Current Motors" and of chapters on "Transformers" and "Motors" in the Standard Handbook for Electrical Engineers. He is a member of the American Association for the Advancement of Science, American Electrochemical Society, National Electric Light Association, the New York Electrical Society, a Fellow and Manager of the American Institute of Electrical Engineers, a member of the Society for the Promotion of Engineering Education and is president of the Illuminating Engineering Society, 1914-1915. He is a member of many social and fraternal organizations.

A. S. McAllister.

OBITUARY.

MR. JORDAN LAWRENCE MOTT, president of the J. L. Mott Iron Works, New York, N. Y., died at the age of 85 years, on July 27.

MR. GEORGE RIPLEY STETSON, for many years president of the New Bedford Gas and Edison Light Company, New Bedford, Mass., died at his home in that city July 26, at the age of 78. He was a native of Brooklyn, N. Y., and early learned the machinist's trade. He entered the employ of a rifle manufacturer and was sent to Brazil to set up an arms factory for that government. Coming to New Bedford in 1873 he became superintendent of a machine company, and in 1890 resigned that position to become the head of the lighting corporation. He was president of the New Bedford Co-operative Bank from 1891 until his death, and held various public offices in his city. He was president of the Republican city committee and of the Board of Trade several years. Mr. Stetson was a member of the National Electric Light Association and of several engineering societies, and had traveled in Europe in connection with attendance on conventions. He was a member of the Knights Templars. The widow and four children, one of whom is the wife of Mr. David W. Beaman, of the lighting company, survive.

With the Electrical Manufacturers

The Davis Slate and Manufacturing Company, manufacturers of electrical slate, Chicago, Ill., announces the appointment of R. W. Ten Broeck as manager of its Detroit branch.

The King Foundry Company, St. Joseph, Mo., has prepared an illustrated poster for the trade which advantageously displays its line of new standards for ornamental street lighting.

The Ohio Brass Company, Mansfield, O., has sent out folders calling attention to the peculiar merits of O-B extruded trolley ears. These are made for various conditions.

J. H. Parker, Incorporated, Parkersburg, W. Va., manufacturer of electrical insulations, has opened a Pacific Coast branch office in the Rapp Building, 121 Second Street, San Francisco, Cal. H. S. Perkins is in charge of this branch and will look after the porcelain interests of the firm on the Coast.

Connecticut Telephone & Electric Company, Meriden, Conn., has issued bulletin No. 50. This deals with apartment-house telephone systems, particularly those for use between the building entrance and the various apartments. These are made both common-talking and non-interfering. One of the most unique of these sets is the new cordless outfit.

The Robbins & Myers Company, Springfield, O., has secured the contract for supplying 101 electric fans for the new United States Post Office building at New Orleans, La. Of this batch, 82 fans will be 16-inch oscillating fans and 19 will be ceiling fans; all are to operate at 110 volts direct current. The contract was secured through S. J. Stewart, local agent for the company.

The Electric Cable Company, New York City, has established an office in the Peoples' Gas Building, Chicago, Ill., under the management of James W. White, who for a number of years has been connected with the Union Switch & Signal Company as special representative and assistant to the vice-president in charge of sales. James M. Brown, formerly with the Lorain Steel Company, and Cyrus R. King, formerly with the Pittsburgh Steel Products Company, have also been assigned to the Chicago office.

McFell Signal Company, Halsted and Twenty-ninth Streets, Chicago, Ill., has issued some new publications on its signaling systems. One of these describes two of the McFell fire-alarm systems and the combination fire-alarm and watchman service. Circuit diagrams and parts of the equipment are shown. All these systems are continually under test for circuit trouble. Another pamphlet describes McFell special signal systems. Of these the direct signal call is a code system to summon an executive officer from any department of a large office, factory or institution. The detective call is a system for department stores, etc., to direct a detective to some particular part of the store in an inconspicuous way. The registry call permits an executive to register his progress about an establishment. The registry clock system keeps a record of all calls in hospitals, institutions, etc.

DATES AHEAD.

American Institute of Chemical Engineers. Seventh semi-annual meeting, Los Angeles, Cal., August 16-19; San Francisco, Cal., August 25-28. Secretary, J. C. Olsen, Cooper Union, New York, N. Y.

International Association of Municipal Electricians. Annual meeting, Gibson Hotel, Cincinnati, O., August 24-27. Secretary, C. R. George, Houston, Tex.

Indiana Electric Light Association. Annual convention, Hotel Deming, Terre Haute, Ind., September 8-10. Secretary, T. Donahue, La Fayette, Ind.

Pennsylvania Electric Association. Annual convention, Bedford Springs, Pa., September 8-10. Secretary, H. N. Mueller, 435 Sixth Avenue, Pittsburgh, Pa.

Association of Iron and Steel Electrical Engineers. Annual convention, Hotel Statler, Detroit, Mich., September 8-11. Secretary, W. T. Snyder, McKeesport, Pa.

Northwest Section, National Electric Light Association. Annual convention, Portland, Ore., September 8-11. Secretary, N. W. Brockett, Pioneer Building, Seattle, Wash.

Association of Edison Illuminating Companies. Annual convention, Spring Lake, N. J., September 13-16. Secretary, George C. Holberton, San Francisco, Cal.

Electrical Supply Jobbers' Association. Quarterly meeting, Clifton Hotel, Niagara Falls, Ont., September 14-16. Secretary, Franklin Overbagh, 411 South Clinton Street, Chicago, Ill.

New England Section, National Electric Light Association. Annual convention, Mt. Kineo House, Kineo, Me., September 14-17. Secretary, O. A. Bursiel, 149 Tremont Street, Boston, Mass.

American Institute of Electrical Engineers. Panama-Pacific convention, San Francisco, Cal., September 16-18. Secretary, F. L. Hutchinson, 33 West Thirty-ninth Street, New York, N. Y.

American Electrochemical Society. Twenty-eighth general meeting, San Francisco, Cal., September 16-18. Secretary, Joseph W. Richards, South Bethlehem, Pa.

Illuminating Engineering Society. Annual convention, New Willard Hotel, Washington, D. C., September, 20-23. Assistant secretary, Joseph Langan, 29 West Thirty-ninth Street, New York, N. Y.

International Engineering Congress, San Francisco, Cal., September 20-25. Executive secretary, E. J. Dupuy, Foxcroft Building, San Francisco, Cal.

Telephone Pioneers of America. Annual meeting, San Francisco, Cal., September 21-23. Secretary, R. H. Starrett, 15 Dey Street, New York, N. Y.

Record of Electrical Patents

Issued by the United States Patent Office, July 20, 1915.

Prepared by Thomas Howe, Patent Attorney, 2 Rector Street, New York, N. Y.

1,146,786. Telephone System. B. M. Davis, assignor to Automatic Electric Co., Chicago, Ill. Substation calling mechanism for automatic telephone.

1,146,788. Combustion Engine. G. Fornaca, assignor to F. I. A. T., New York, N. Y. Driving connection of magneto and distributor.

1,146,791. Art of Treating Tubes Interiorly With Liquid Coating Agents. E. T. Greenfield, Kiamesha, N. Y. Manner of spraying and smoothing coating in conduit.

1,146,800. Ignition Device for Internal Combustion Engines. J. S. Kendall, Hamilton, Ont., Canada. Multiple spark plug producing succession of sparks per stroke.

1,146,806. Battery Case. R. H. Manson, assignor to Garford Mfg. Co., Elyria, O. Has contacts for connecting dry cells and prevents wrong connection.

1,146,821. Semi-Automatic Telephone System. M. Schwartz, assignor to Automatic Electric Co. Comprises automatic means for maintaining impulse transmitter connected with idle trunk.

1,146,833, 1,146,834 and 1,146,835. Trolley-Catcher. M. A. Yeakley, assignor to J. E. McLain, Canton, O. First patent, centrifugal dog stops drum and cushioning means relieves impact. Second and third patents, drum-stopping means maintained operative during rebound.

1,146,867. Magnetic Chuck. W. S. Griffith, assignor to Heald Machine Co., Worcester, Mass. Magnetically insulated pole piece in face plate and work holders of magnetic material.

1,146,872. Combination Electrical Switch and Clutch-Actuating Mechanism. E. V. Hartford, Deal, N. J. Clutch and switch automatically opened and common closing means.

1,146,877. Trolley Mechanism. J. Hollis, assignor to J. E. McLain, Canton, O. Trolley-catcher has drum-stopping means maintained operative during rebound.

1,146,879. Automatic Electric-Heating System for Railroad Cars and the Like. L. P. Hynes, assignor to Railway Utility Co., Chicago, Ill. Thermostatic control.

1,146,881. Binding-Post. N. J. Jeffries, Atlantic City, N. J. Bolt extending through wall has slotted head for screw driver, axial bore for wire and cap covering head for clamping wire end.

1,146,883. Burglar-Alarm. J. Jones, Jr., New York, N. Y. Primary circuit closed by alarm device closes secondary circuit for continuous ringing.

1,146,885. Casing for Lamp Sockets. C. J. Klein, assignor to Cutler-Hammer Mfg. Co., Milwaukee, Wis. Cap and shell snap together and are separated by tool.

1,146,889. Telephone-Exchange System. F. A. Lundquist, assignor to Western Electric Co., New York, N. Y. Automatic; separate means for connecting and maintaining connections of line with trunk, connecting means being moved to idle trunk contacts after each connecting operation.

1,146,924. Storage-Battery Regulator. F. Conrad, assignor to Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Charging regulated by specific gravity of electrolyte.

1,146,925. Electrical Regulator. F. Conrad, assignor to Westinghouse Electric & Mfg. Co. Vibratory-contact field regulator controlled by condition of distribution circuit and differential action of exciter current and voltage.

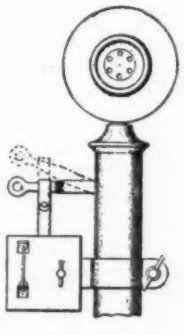
1,146,926. Regulator for Electrical Circuits. F. Conrad, assignor to Westinghouse Electric & Mfg. Co. Details of vibratory-contact field regulator.

1,146,927. Electrical Regulator. F. Conrad, assignor to Westinghouse Electric & Mfg. Co. Modification of above.

1,146,935. Lighting Fixture. E. F. Guth, St. Louis, Mo. Structure of bowl for semi-indirect lighting.

1,146,938. Attachment-Plug Receptacle. H. Hubbell, Bridgeport, Conn. Covering block has T-shaped slots to receive standard plug contacts whether in parallel or alinement.

1,146,939. Electric-Lighting Device for Vehicles. D. C. Hughes, assignor to Hughes-Wessling Co., Chicago, Ill. Generator frictionally driven from wheel rim.



No. 1,147,014.—Fire Alarm.

1,146,942. Process of Treating Liquids. C. P. Landreth, Philadelphia, Pa. Electrically treated prior to adding agent for precipitating foreign matter to be removed.

1,146,954, 1,146,955 and 1,146,956. Electric Regulator. F. E. Ricketts, Baltimore, Md. Vibratory-contact field regulators; first patent has the contacts adjustable according to circuit conditions; second patent, vibratory contacts control generator connected to field circuit of exciter; third patent, vibratory contacts actuated by differential magnet, auxiliary coil being controlled by relay in field-resistance shunt.

1,146,976. Ignition Apparatus. R. Varley, assignor to Varley Duplex Magnet Co., Jersey City, N. J. Structure of generator collector rings, commutator, etc.

1,146,979. Trouble Lamp. F. A. Walters, W. M. Beckman and A. W. Kohl, Minneapolis, Minn. Cap fitted with battery and lamp.

1,146,985. Printing-Telegraph. C. J. Wiley, Yorktown, N. Y. Plurality of instruments operated by single tape.

1,146,988. Depositing Repair Metal Across an Alternating-Current Arc. M. Arendt, assignor to H. L. J. Siemund, New York, N. Y. Arc brazing; has inductance in series with arc with inductive voltage greater than drop across arc.

1,146,989. Electric Arc Welding. M. Arendt, assignor to H. L. J. Siemund. Current variations by resistance of arc vary circuit voltage in opposite sense.

1,146,993. Block-Signal Apparatus. A. Bevan, Providence, R. I. Step-by-step system for trolley roads.

1,147,005. Electric Regulation. J. L. Creveling, assignor to Safety Car Heating & Lighting Co., New York, N. Y. Automatic generator regulator for car lighting.

1,147,010. Wireless Telegraphy. R. A. Fessenden, assignor to S. Kinter, Pittsburgh, Pa., and H. A. Barrett, Bloomfield, N. J. Antenna structure.

1,147,014. Automatic Fire-Alarm System. F. Gottschalk, Stirling, N. J. Telephone hook moved to "talking" position on fusing of link. (See cut.)

1,147,016. Electromagnetic Sound-Producer. L. Grubman, assignor to Electric Spark Appliance Co., New York, N. Y. Automobile horn; electromagnetic vibrator beats upon diaphragm.

1,147,020. Accounting System. F. O. Heuser, assignor to W. R. Heath, Buffalo, N. Y. Electromagnetically actuated register.

1,147,021. Means for Protecting Electric Conductors. J. T. Hickey, assignor to Hickey & Schneider, New York, N. Y. Shields conductor from injury at insulator.

1,147,025. Telephony. M. L. Johnson, assignor to Frank B. Cook Co., Chicago, Ill. Automatically selects idle operator set and connection transferable to other operator's set at will; also signals denoting idle link connectors.

1,147,026. Electrode for Vapor Electric Apparatus. C. A. Kraus, Newton Highlands, and R. D. Mailey, Lynn, Mass. A mercury cathode has layer of granular insulating material floating thereon.

1,147,038. Igniter Magneto-Generator. H. C. Mueller, assignor to Evinrude Motor Co., Milwaukee, Wis. Structural details of reversible machine.

1,147,052. Fire and Police-Alarm Box. W. F. Smith, assignor to Western Electric Co. Details of impulse transmitter.

1,147,053. Resetting Signalling Device. C. W. Stancliffe, assignor of one-fourth each to R. J. Leckie and W. H. Leckie, Vancouver, B. C., Canada. Solenoid operates contact-maker.

1,147,065. Insulator Clamp or Bracket. J. Zieg, Lincoln, Neb. Sheet-metal strap embraces crossarm and forms insulator pin.

1,147,071. Polyphase-Current Starter. E. Besag, assignor to Voigt & Haeffner Actiengesellschaft, Frankfort-on-the-Main, Germany. Lever sets rotor starter and tensions springs of stator switch.

1,147,107. Electrical Machine. F. Ljungström, assignor to Aktiebolaget Ljungströms Angturbin, Finspang, Sweden. Armature conductors and core interlocked to prevent circumferential movement.

1,147,123. Connection for Continuous-Current Generators. L. Schön, assignor to Fried. Krupp Aktiengesellschaft, Essen-on-the-Ruhr, Germany. Arrangement of exciter circuit.

1,147,125. X-Ray Tube. J. E. Seeley, Los Angeles, Cal. Arrangement of cathodes and target.

1,147,127 and 1,147,128. Combined Load-Indicator and Alarm for Motor Trucks. F. J. Troil, Baltimore, Md., assignor of one-half to D. H. Thomas, Jr. First patent, audible indication when maximum load of truck is reached. Second patent, modification.

1,147,150. Method of Obtaining Oxide of Nitrogen From Atmospheric Air. F. I. duPont, Wilmington, Del. Comprises subjection to electric arc.

1,147,165. Electrical Furnace. W. H. Hampton, assignor to Conley Electric Furnace Co., Wilmington, Del. Vertical furnace; reactions with the material facilitated by resistance heating of plates over which it passes.

1,147,168. Electric Motor. R. M. Gilson, assignor to Union Switch & Signal Co., Swissvale, Pa. Split-phase motor, power-factor of one winding increasing with frequency.

1,147,169. Railway - Traffic - Controlling Apparatus. J. S. Holliday, assignor to Union Switch & Signal Co. Single-phase repulsion motor operates track switch and supplies current to indicator motor.

1,147,170. Electric Motor. J. S. Holliday, assignor to Union Switch & Signal Co. Split-phase motor, windings having equal power-factors at one frequency and power-factor of one winding higher than other at higher frequency.

1,147,171. Apparatus for the Control of Electric Motors. J. S. Holliday, assignor to Union Switch & Signal Co. Split-phase motor operates circuit-breaker controlling track-switch motor.

1,147,186. Multicolor Loom. J. Pointu, Roanne, France. Electrical means, controlled by exhaustion of weft, for inserting fresh shuttle.

1,147,205. Portable Electric Lamp. C. Bertram, assignor to Morreau Co., Cleveland, O. Structure of lamp standard, with wiring conduit, etc.

1,147,209. Apparatus for Electric Welding. W. B. Cleveland, assignor to Electric Railway Improvement Co., Cleveland, O. Has high-resistance heating electrodes between which work is clamped.

1,147,223. Lock - Out Party-Line Telephone System. A. F. Erickson, Seattle, Wash., assignor of one-fourth each to J. V. Bock and G. T. Nonnenbacher. Lock-out device consists of two electromagnets with special wiring and structure.

1,147,246. Telephony. M. L. Johnson, assignor to Frank B. Cook Co., Chicago, Ill. Operator-controlled, electromagnetic connecting switches at exchange.

1,147,247. Spark Plug. S. M. Kitchen and N. J. Hoag, Skaneateles, N. Y. Structure of plural-gap plug.

1,147,261. Method of Regenerating Storage Batteries. C. S. Palmer, Newtonville, Mass. Sulphated lead batteries regenerated by charging and discharging with electrolyte of concentrated water solution of acid sulphate of alkali metal.

1,147,265. Production of Ozone. J. R. Quain, London, England. Air passed between tubular insulating envelope and a contained tube exhausted of air and containing electrically vaporized mercury.

1,147,269. Luminous Switch-Key. M. T. Rosenheim, Philadelphia, Pa. Cavity in key has translucent walls and is coated with luminous material.

1,147,277. Electric Cigar-Lighter. M. H. Spielman, New York, N. Y. Structural arrangement of device having high-resistance wire gas igniter.

1,147,282. Stethoscope. K. M. Turner, assignor to General Acoustic Co., Jamaica, N. Y. Telephonic.

1,147,312. Telephone Attachment. D. J. Daniel, Little Rock, Ark. Fresh tape, after each use, may be drawn from roller across mouthpiece.

1,147,323. Recording and Indicating Apparatus. G. A. Hobart, Paterson, N. J. Tally sheet and marker arranged to close signal circuits distinctive according to tally.

1,147,329. Speedometer. W. G. Leathers, assignor to Stewart-Warner Speedometer Corporation, Chicago, Ill. Indicating band moved in opposite directions by drums magnetically and spring-operated, respectively.

1,147,344. Vehicle Lamp. H. A. Spear, assignor of one-half to J. W. Stacy, Springfield, Mass. Construction and arrangement of reflector.

1,147,347. Service - Meter System for Telephone Exchanges. H. S. Turner, San Diego, Cal. Register associated with line operative when line is calling and inoperative when called.

1,147,359. Step-by-Step Electrical Transmitting and Receiving Apparatus. A. Barr, W. Stroud and J. W. French, assignors to Barr & Stroud, Ltd., Anniesland, Glasgow, Scotland. Operated by successive energization of electromagnets and direction of receiver is reversed without reversing direction of transmitter.

1,147,388. Electric Heater. E. E. Gold, assignor to Gold Car Heating & Lighting Co., New York, N. Y. Resistance wire wound on grooved cylinder to promote air circulation.

1,147,389. Automatic Telephone System. C. L. Goodrum, assignor to Western Electric Co., New York, N. Y. Details of switch arrangement.

1,147,390. Switches and Circuits for Automatic Telephone Exchanges. C. L. Goodrum, assignor to Western Electric Co. Has subscribers' circuits arranged in groups and a series of switches less in number than the number of subscribers' lines.

1,147,416. Vaporizing Device. H. P. Macdonald, Montclair, N. J., assignor of one-half to U. Snead. Porous wick soaks up liquid, which is vaporized therefrom by electric heat.

1,147,417. System of Distribution. L. C. Marburg, assignor to Allis-Chalmers Mfg. Co., Milwaukee, Wis. Flywheel induction machine acts as power-storing and delivering device on variably loaded circuit.

1,147,422. Arc-Light Electrode. W. R. Mott, assignor to National Carbon Co., Cleveland, O. Contains a fluoride and zinc oxide.

1,147,437. Sending Device. J. N. Reynolds, assignor to Western Electric Co. Structure of impulse sender for automatic telephone.

1,147,444. Automatic Train Stop or Signal Device. O. A. Ross, assignor of one-half to C. V. Kasson, Chicago, Ill. Block system in which a section of track in a block may be excluded from circuit.

1,147,448. Fuse Device. E. O. Schweitzer, Chicago, Ill. Makes wide gap in circuit on blowing of fuse; for mounting on pole.

1,147,450. Terminal Clip. W. Shaw, assignor to National Carbon Co. Consists of

No. 1,147,532.—Receptacle and Plug.

flattened tube in which conductor is clamped.

1,147,451. Pigtail Connection. W. Shaw, assignor to National Carbon Co. Manner of connection to carbon brush.

1,147,483. Pyrometer Method and Apparatus. T. W. Clark, assignor to Gibb Instrument Co., Pittsburgh, Pa. Electrically controlled recording mechanism in device for determining temperature of highly heated fluid.

1,147,494. Fuse Cartridge. G. E. Fisher, Cleveland, O. Structure of casing for inclosed fuse.

1,147,498. Divided Insulator. E. H. Freeman, assignor to Trenton Porcelain Co., Trenton, N. J. Reversible, interchangeable cleat.

1,147,501. Automatic Annunciator. J. H. Genter, Newburgh, N. Y. Electromagnetically controlled slide carrier for projecting apparatus.

1,147,516. Machine for Preparing the Conducting Wires of Electric Igniters. J. Krannichfeldt, Cologne-Niehl, Germany. Details of machine for manipulating and cutting conducting wires.

1,147,532. Electric-Lamp Receptacle and Plug. T. A. Morris, Lansford, Pa. Receptacle and lamp plug adapted to snap together. (See cut.)

1,147,545. Bell-Ringing Device. E. Rebischung, New York, N. Y. Electrically operated means for swinging a bell.

1,147,557. Fire-Extinguisher. A. C. Seeger, East St. Louis, Ill. Alarm circuit closed by operation of fusible sprinkler head.

1,147,558. Apparatus for the Sterilization of Milk. A. Shelmerdine, Liverpool, England. Particular structure for passing electric current through milk.

1,147,569 to 1,147,576, inclusive. Electrical Regulator. A. A. Tirrill, assignor to Westinghouse Electric & Mfg. Co. Eight patents on different structures and connections of vibratory-contact field regulators.

1,147,584. Apparatus for Electrically Controlling Planing Machines and the Like Reciprocating Tools. A. P. Wood, Hale, England. Bed plate automatically controlled by controlling field circuit of generator supplying driving motor.

1,147,585. Apparatus for Electrically Operating Planing Machines and the Like Reciprocating Tools. A. P. Wood and R. S. McLeod, Didsbury, near Manchester, England. Details of automatic control of driving motor.

1,147,596. Electromechanical System to Avoid Railway Collisions. A. Beer, Venice, Italy. Counterweight holds signal at "danger" and electric mechanism moves it to "clear."

1,147,598. Distributor for Electric Igniters. C. T. Blake, St. Petersburg, Fla. Particular structure.

1,147,634. Automobile Lock. G. L. Lotz and J. W. Kremer, Seattle, Wash. Starting apparatus including igniter switch locked against unauthorized use.

1,147,636. Telegraph Repeater. J. McKeon, Great Falls, Mont. Structure and arrangement of magnets and contacts comprising heavy-current main-line magnet and light-current local-circuit magnet.

1,147,642. Automobile Door - Opening Mechanism. T. A. J. Porter, Tuckahoe, N. J. Electromagnetically operated lever mechanism for opening spring-closed sliding door.

1,147,666. Apparatus for Electrically Operating and Controlling Planing Machines and the Like Reciprocating Tools. A. P. Wood, Hale, England. A motor for each direction of movement and electric changeover mechanism.

1,147,682. Lifting Magnet. D. C. Jackson, assignor to D. C. Jackson and W. B. Jackson, Madison, Wis. Structure of pole pieces, etc.

1,147,686, 1,147,687 and 1,147,688. Electrical Regulator. O. S. Schairer, assignor to Westinghouse Electric & Mfg. Co. Structures and connections of vibratory-contact voltage regulators.

1,147,692. Electrical System of Distribution. F. G. Beetem, Philadelphia, Pa. For charging storage batteries; dynamo voltage maintained substantially constant by armature field connected through arms of Wheatstone bridge.

1,147,696. System of Electrical Distribution. J. L. Woodbridge, Philadelphia, Pa. Automatic regulation in systems having storage battery floated on line.

Patents Expired.

The following United States electrical patents expired on August 2, 1915:

608,175. Reciprocating Electric Drill. H. Casler, Canastota, N. Y.

608,211. System for Heating by Electricity. J. F. McElroy, Albany, N. Y.

608,228. Galvanic Bath. C. E. Schnee, Carlsbad, Austria-Hungary.

608,234. Insulating Caster and Electric Switch Combined. A. W. Slayton, Tecumseh, Mich.

608,236. Electrical Signaling Apparatus for Transmitting Commands. C. Aridt, Berlin, Germany.

608,249. Alternating-Current Induction Motor. C. S. Bradley, Avon, N. Y.

608,258. Electric Bond for Railway Rails. S. H. Harrington, New York, N. Y.

608,269. Electric Arc Lamp. C. A. Pluger, Chicago, Ill.

608,277. Armature for Dynamo-Electric Machines. E. H. Anderson and D. P. Thomson, Schenectady, N. Y.

608,281. Trolley. F. E. Case, Schenectady, N. Y.

608,300. Electrolytic Apparatus. J. G. Rhodin, Eccles, England.

608,301 and 608,302. System of Train Control. E. W. Rice, Jr., Schenectady, N. Y.

608,307. Electrical Distribution. C. P. Steinmetz, Schenectady, N. Y.

608,308. System of Electrical Distribution. C. P. Steinmetz.

608,309. Regulating Dynamo-Electric Machines. C. P. Steinmetz.

608,319. Electromechanical Lock. H. G. Carleton, New York, N. Y.

608,320. Electric Combination Lock. H. G. Carleton.

608,321. Electric Lock. H. G. Carleton.

608,322. Combination Mechanism for Electric Locks. H. G. Carleton.

608,333. Telegraphic Transmitting and Receiving Apparatus. B. Hoffmann, Paris, France.

608,340. Automatic Switch for Regulating Electric Air Compressors. M. Mosely and P. Funck, Rochester, N. Y.

608,343. Electric Heater. J. F. McElroy, Albany, N. Y.

608,389. Rapid Telegraphic Transmission on Cable Lines. C. L. Davies, London, England.

608,412. Joint for Electric Conductors. H. S. Patten, Montclair, and W. Maver, Jr., Jersey City, N. J.

608,497. Electric Headlight Lamp. H. P. Wellman, Ashland, Ky.

608,504. Telephone-Transmitter Arm and and its Attachment. W. J. Barr, Ashtabula, Ohio.

608,537. Battery Electrode. H. E. Wilkinson, Mount Vernon, Ohio.

Electric Vehicle Section

THE PURCHASE AND CARE OF THE INITIAL TRUCK.[1]

By G. Drake Smith.

While the electric has been on the market for nearly fifteen years, the average merchant or plant manager is still likely to be influenced by hearsay or personal bias in buying his first truck. A relative or business friend will brag about such and such a truck and Mr. Jones will order one without considering the question of capacity or adaptability. If he does not do this the chances are he will buy a truck made by the manufacturer of his touring car, forgetting that a truck and a touring car are very different. It is very difficult to get the buyer of the initial truck to take his first investment seriously. A small percentage make a very thorough investigation of different makes, but the majority buy on first price, friendship or snap judgment.

I do not hold the truck manufacturer blameless, especially in years past, because if he had had the patience to make sure that the truck sold was specifically adapted to the needs of the buyer, much dissatisfaction would have been avoided and more sales made. The older manufacturers, however, have for some years sacrificed many immediate sales to a policy of adaptability, and this policy is now bearing fruit.

Mistakes No Longer Necessary.

In many respects the man who is now about to buy his first truck has certain advantages over the man who bought his even three years ago. It is no longer necessary to make mistakes in adaptability, especially if one deals with the reputable, experienced manufacturer. Engineering counsel is supplied in modern motor-truck selling not only to aid the buyer, but to protect the seller. For the latter to make mistakes is to endanger his future sales, not alone to the buyer in question, but to others influenced by the initial sale.

Ten years ago the electric truck manufacturer was greatly handicapped in adapting his product to the needs of the buyer. For the buyer would consider only horse-wagon standards and these we know now were lamentably wanting as a foundation for efficiency. The American Express Company, for example, first bought three-ton trucks, then one-ton, then two-ton, the proper size for the bulk of their work. The Adams Express Company started in with one-ton in 1903; then one and one-half ton; then reached the two-ton size. Many wholesale grocers began with the five-ton size only to drop down to the three and two-ton. Nearly every line of business had to experiment, and with no experience to guide him, the electric truck manufacturer could only consent to build what the buyer ordered.

To-day the large manufacturer knows from long experience just what to recommend for all the lines of trade which approach standard practice in bulk or dead-weight units. A 1,000-pound General Vehicle department-store wagon, for example, has a body whose dimensions are about the same as the old single-horse retailer's wagon, standardized through nearly 70 years' use. It has a speed of 12 miles per hour, and 45 to 50 miles per standard battery charge. The speed conforms to traffic conditions and city ordinances. The mileage is limited not to what the largest battery one can get into the wagon will give; not to what a half-ton wagon at 12 miles can cover in nine or ten hours, but to the average mileage needs of the merchant's delivery service. Why carry about more battery than you need, cutting down load capacity and unnecessarily shortening tire life? Other G. V. models are equally efficient for business needs. The chassis of the two-ton size is adapted to bodies which are standard in eighteen lines of business. The heavy duty, five-ton size is also well proportioned to the body needs of the coal man, the ice man, the brewer, etc.

Providing Exactly What the Work Demands.

But it is in predetermining what capacity of vehicle, what style and size of body, what speed and what size of motor and battery are needed for a given task and then supplying these, that our company has made its greatest progress in "fool-proof selling."

For example, in Pittsburgh, we made little headway with the brewers until we practically placed five-ton motor and battery equipment in three-and-one-half-ton trucks, and carried out this general idea in other capacities. By way of contrast, we have placed three-and-one-half-ton batteries in five-ton ice trucks where the haul was not over 2,500 feet and the smaller batteries were more than ample for a full day's work. The decrease in battery weight allows loads to be correspondingly increased over normal, without straining the frame of the truck. In other cases we have increased the size of the battery to take care of the extra current needed to operate an electric winch on the truck. We use extra large powerful motors to overcome sandy conditions in the South, and hills in Australia. Having frame trouble in Los Angeles, we investigated and found that due to the heavy rainfall the curb stones on the street gutters are from three inches to five inches higher than usual and iron-bound. This means that a truck going into a garage or stable would have to climb a sudden rise of often 36 inches (or a 33 per cent grade), bringing an extra heavy strain upon the frame. We now reinforce the frames of all vehicles sent to Los Angeles. In San Francisco, to negotiate the hills in good shape, batteries specifically adapted to the capacity of vehicle and the local routes are installed, in one instance a special motor and a battery with 64 cells being used.

Particular attention is now paid to the installation of G. V. trucks in the smaller towns where people have no knowledge of storage-battery practice and would naturally get into trouble with charging equipment if not properly coached. We also make a special effort to help our customers in cities where there is a heavy snow fall. We have mill trucks in service where the hauls do not exceed 100 yards and due to speeding up the loading and unloading methods have made these trucks pay.

In many cases it is not the standard trucks which are at fault but methods connected with loading and unloading them. I have in mind two trucks in a Maine mill town which gave dissatisfaction, because while they moved coal, sand, bales of cotton and finished goods they did no more work than the

[1] A paper read before the Ohio Electric Light Association, Cedar Point, Ohio, July 23, 1915.

former horse equipment. To load a truck two men would go inside the mill, get a roll of goods and nonchalantly go back for another. After studying the situation, our engineer suggested that as the rolls of cloth came from the loom instead of laying them on the floor to be taken out individually they be dropped into a bin built on a small truck, this to be kept near the loom. Twelve small trucks equipped with ball-bearing castors were built at the mill, of a size to just fit on a one-ton G. V. Boys ran the hand trucks to the door the minute the electric backed up, ran off the empty roll truck and pushed in a full one, the operation consuming about 30 seconds. With one one-ton electric we then did the work which formerly required seven men and four horses, the hauls being about 300 yards.

In another mill this problem of waste time in loading has also been overcome by constructing small floor trucks for work all through the mill. A two-ton electric holds four of these standard units, a three-and-one-half-ton truck, six. The haul of the electrics does not exceed 100 yards and there are 16 stops in a round trip, yet the electrics pay over horses. The scientific loading methods alone make this possible.

Not only are we overcoming the very-short-haul problems but we are making rapid progress in solving long-haul difficulties. A large firm in Boston wanted a five-ton electric which would enable it to haul capacity loads to Waltham, 12 miles, and to Quincy about nine miles, or 42 miles for the two trips. Our standard five-ton truck normally covers but 35 miles per charge, but by boosting for one hour we were able to give him 44 miles per charge. By means of relay batteries, more particularly a spare battery at the out-of-town end of the trip, we have enabled some customers to secure 70 miles per day with three-and-one-half-ton trucks, while 60 miles per charge with one-half and one-ton wagons, with batteries slightly larger than normal, is very common. Where we have the Battery Service System all mileage standards go by the board. A one-ton G. V. in Spokane, Wash., recently covered 7,405 miles in four and one-half months or at the rate of nearly 18,000 miles per year. The cost was 5.05 cents per mile.

Adaptability in the Central-Station Field.

About four per cent of the nearly 5,000 central stations in the United States operate electric trucks, yet the electric truck manufacturer has received more criticism from this field than from any other

The transportation needs of the public utility are many and complex. Vehicles purchased for one class of work are frequently used for another. This would cause some dissatisfaction. Then a great many central-station electrics are not standard. The manufacturer following the specifications insisted upon by the central station produces what is asked for but which is not always satisfactory. Spare parts for special vehicles are of necessity made to order. Should the truck as well as the manufacturer be condemned because there is some delay in supplying these? If your engineering department practically rebuilds a G. V. electric to suit your ideas of what it should be and it does not "make good," are we at fault?

I concede our failure to do many things which might have tended to make our vehicles in some cities do better work, many things which might have given you just what you needed for a specific purpose, but we are correcting these evils as fast as we can. We cannot build a special gas-electric vehicle for one manager, front-wheel drive vehicles for other managers and make any pretense of selling a standard line, to say nothing of selling such vehicles at list prices. Someone has to bear the development expense. I'll guarantee that if we would we could book orders for 75 specials from every 100 central stations.

Against the stated imperfections of electric wagons and the faults of a manufacturer such as I represent, must be weighed the numerous examples of neglect, yes, plain every-day abuse, of hundreds of electrics in central-station service. I have in mind a wagon which I sold myself in this state—a one-ton tower wagon. I tried to make it a two-ton tower wagon but was told the one-ton would be quite sufficient as it would only carry the tower, a few tools and two men. Today (15 months later) that wagon is practically for sale. The engineers complain of poor service and a mileage of 21 per charge. But—that wagon was soon carrying in addition to the tower a *complete set of line repair equipment, and from three to five men.* In 14 months three sets of tires were needed for the rear wheels and two for the front. Our inspector found the weight of the equipment, including driver, to be 8,570 pounds. No wonder the body rides on the axle. I could cite many other cases of, shall I call it, *inadaptability?*

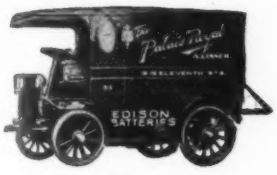
On the other hand our company owes a great deal to the central-station engineers who have co-operated with us in developing vehicles necessary for special work or for service under peculiar operating conditions. It also owes a great debt to the central stations who have not only generously adapted the electric for their own work but influenced the purchase of others by the local merchant and manufacturer. We are trying hard to co-operate fully with such companies and we are also trying very hard to properly sell and install the initial truck purchased by the central station just beginning to motorize.

The electric truck is a wonderful vehicle when adapted to the work and properly cared for. In April, 1913, we placed a two-ton, winch-equipped cable truck in the service of the Duquesne Light Company, of Pittsburgh. In 18 months this truck made but 4,175 miles, yet in that time it pulled 200,000 feet of cable at a cost of 1.1 cents, against 2.4 cents for hand-winch pulling. Increased speed and reduction in the number of men required made this possible. In the first seven months of its use this truck saved $2,700 over the old method, these figures being given over the signature of the general contract agent. The cost of a two-ton G. V. chassis is $2,600.

The Duquesne Light Company was good enough to place another one of its two-ton trucks at the disposal of the Pittsburgh Board of Education for a two-day demonstration in competition with a gasoline truck. This truck distributed Christmas trees. The first day it covered 33 miles, using 285 amperes. Loose snow, ice, rough roads and steep hills were encountered.

On the second day all schools in the Alleghany district were covered. "With the driver," states the report, "was the driver of a gasoline truck who stated that some places were reached which could not be reached with a gas truck. Mileage 35, amperes consumed 286. No more unfavorable operating conditions could be asked for."

I mention Pittsburgh, because I want to indicate our success under extraordinary conditions, believing that some of you central-station users who are not satisfied with your electrics will be influenced to set your jaws and say, "If they can do it, I can—there must be something wrong with our garage people if they cannot keep an electric going in a level country." I could give you many examples of G. V. performance on the Pacific Coast, not from hearsay but as an eye-witness. A little care and common sense will overcome half the central-station troubles with electrics. Even where a one-ton store-room wagon makes but from 12 to 17 miles a day (against its possible 45 or 50), there is no excuse for an operating cost of from 50 to 90 cents a mile, as some central-station figures show. Either the wagon is not adapted to its work and should be placed in another department, or it is



WASHINGTON, D. C.

NEW YORK

SAN FRANCISCO

LOS ANGELES

DETROIT

If They Said It To You?

IF **Geo. Stevens,** Superintendent of the Motor Vehicle Department of the Adams Express Co., came to you and said "22 trucks at Indianapolis equipped with Edison Batteries have averaged 660 miles per month for **5 years.** The cost of operating (including **all** battery repairs, new solution, watering, inspection, labor, material **and current**) averaged 2½ cents per mile for the 880,000 miles."

IF **Thos. Breman,** Chief Engineer, R. H. Macy & Co., came to you and said "The eighteen A6 Edison Batteries which we put in service have given from four to four years and six months continuous service in every case. This means every working day at an average mileage of thirty-five miles per day."

IF **Chas. S. Morris,** President Metropolitan Fireproof Storage Warehouse Co., came to you and said "We are highly pleased with the operation of the Edison Battery and the amount of mileage has exceeded in many instances that which was promised to us."

WHAT WOULD YOU DO?

WOULD you not investigate the Electric Truck and the Edison Battery?

WOULD you not be impressed by the fact that more than one-third of all Electric Trucks are Edison Equipped?

WOULD you not ponder what USERS say? "Longest life." "Costs least to maintain." "Most economical and satisfactory equipment." "Reliable always."

THE USERS KNOW

Edison Storage Battery Company

Main Office and Factory, Orange, N. J.

Distributors in New York, Boston, Chicago, Detroit, Washington, Seattle, San Francisco, Los Angeles, Portland Ore.

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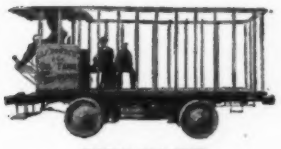

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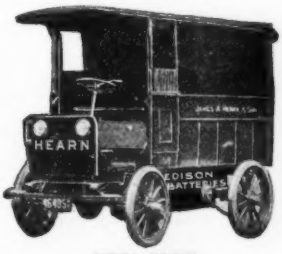

NEW YORK

simply neglected or abused by overloading or both.

Analysis Before Sale.

We believe that far greater efficiency may be secured by analyzing a central station's transportation needs and then recommending just the vehicles necessary to best displace existing horse equipment. In past years we have not had the necessary engineering force to spare to do this but now we are making progress. I have in mind a G. V. report now being considered by a central station operating a traction line as well as lighting.

This company operates 14 single and five double wagons, utilizing 28 horses. There are four single service wagons, four single tower wagons for arc lamp work, one painter's wagon, two single street light maintenance wagons, one single cable wagon, one double pole wagon, one double cable truck, one single conduit maintenance wagon and three extra single wagons for special work and reserves.

Our engineer put recorders on several wagons and went out on them. He noted the running time, the stops and waits, the extra delays, as when foreman could not get on the job for one and one-half hours in some cases, thus tying up the work.

He found that an overhead construction wagon carried nine men whose wages totalled $20 per day. The wagon and two horses represented $3.09 per day. On this work there was a loss of 45 minutes going to work, one hour waiting on hired team, 25 minutes lost on return trip, or two and one-half hours lost in all. At $2 per hour for men, this meant $5 lost on labor alone for this wagon in one day. A hired wagon hauled four tons of cable to the same destination, for which it received $8. A two-ton G. V. truck would have saved the two and one-half hours' delay and hauled the cable as well. This gives an idea of electric truck economy in construction work. The superintendent of a New England central station stated that they could haul more cable from the freight house *after supper* than their hired team did all day.

After all estimates based on technical records and eye witness reports were in, it was found that the work of the 28 horses, 14 single and four double wagons could be done with ten 1,000-pound G. V. wagons and three two-ton trucks, at a saving of $13.53 per day in actual operating costs, besides a much greater saving (perhaps $20 per day) in the time of the men. The electrical equipment, also, would allow the same crews to cover far greater mileages, in fact, provide for a 25 per cent increase in transportation equipment.

From this you will see that the General Vehicle Company does give consideration to the purchase and care of the initial truck. We aim to make certain that, at least from now on, our electrics shall get a fair chance to prove their efficiency. This will be different in some cases because we cannot prevent overloading, nor can we prevent an operator oiling his vehicle only when it squeaks, if he is that neglectful. But we feel that all live central-station men will co-operate with us when they see what we are trying to do, and the right kind of co-operation can move mountains.

Chicago Electric Garages Introduce a Parking System for Waiting Cars.

A long desired service for the users of electric vehicles in Chicago has recently been put into effect through the efforts of the Electric Vehicle Association of America. It is a system of parking waiting electrics in the shopping district of Chicago, and is of an extremely practical and necessary nature, representing a service not extended by any other type of car. As many cities have laws denying the privilege of cars standing stationary for any length of time at the curb in city streets, this is sometimes a considerable hardship if one does not have a chauffeur.

That an electric obviates the necessity of employing a chauffeur is considered one of its greatest advantages. However, women who run their own electrics have for some time realized how difficult it is to use their cars for shopping purposes in the loop. Appreciating this difficulty, several garages have established, under the auspices of the Electric Vehicle Association, a downtown parking service for their customers, enabling them to leave their cars at the Electric Shop of the Commonwealth Edison Company, where a licensed chauffeur drives it to the park and returns it again whenever ordered. There is no charge for this service. The car owner simply understands that by taking advantage of the service he entirely agrees that the driver is acting only in the capacity of the owner's personal agent.

All electric garages who are represented in the Chicago section of the Electric Vehicle Association are participants in this plan, and shortly a notice will be sent to every user of an electric in Chicago and vicinity, telling about the service. In the fall a night service will be arranged for theater patrons.

The parking system is a much needed service which, it is hoped, will be extended to other cities where the electricity supply companies will follow the lead of the Commonwealth Edison Company in its very close and practical co-operation with electric-vehicle interests.

ELECTRICALLY PROPELLED FIRE APPARATUS.

Notes on Their Successful Operation in Various Cities.

By A. Jackson Marshall.[1]

Ever since the first fire department was organized in ancient Rome, for centuries countries have vied with one another in the development of efficient fire-controlling apparatus, endeavoring to make fire the "servant" of man rather than the "scourge" of man. One of the greatest problems has been the propulsion of fire apparatus, and at present the greatest effort is being made to develop motor-propelled appliances. It is interesting to follow the development of fire-fighting from the early period when the "bucket brigade" was the most efficient means of combating the enemy. The hand engine and man-pulled hose carriage were considered marvels of efficiency in their day, but it is with a mixture of curiosity and amusement that we now look upon apparatus relegated to the glass cases and rusty environs of museums. In 1875, shortly after the period of the great fires which devastated some of our cities, a new movement sprang up which heralded the modern building era and modern fire controlling appliances. It was at this time that steam engines came into general use. The inclusion of fire fighting amongst the scientific problems of the day as one worthy of serious consideration dates from modern times, and hence the many improvements which have been introduced into its practice are all of such recent origin that even now they are only just emerging from an embryonic stage.

It is with considerable interest that fire chiefs throughout the country are watching the results and performance of electrically propelled fire trucks and engines in the cities where they have been adopted. The very many obstacles that present themselves in the changing of horse-drawn to motorized apparatus of a large fire department are such that the utmost care must be used to secure that method of propulsion for apparatus that will give speed, reliability, and efficiency together with ease, and economy of operation. In these points the advantage of the electric over other methods of propulsion is fast establishing itself.

The first storage-battery fire engine in this country came into existence in 1912, when Engine 217 of the New York Fire Department was converted into an electrically propelled apparatus.

1 Secretary Electric Vehicle Association of America, 29 West Thirty-ninth Street, New York.

An International Distribution

Not only are G. V. Electrics distributed in 43 of the 48 States but they are used in 9 foreign lands as well. General Vehicle prestige has had a great influence on our foreign sales, but the *quality* of the trucks—their efficiency under a wide range of climatic and other operating conditions—has been an even more important factor.

Our policy of "specific adaptability" concerns itself with the hard problem as well as the easy one. We make G. V. trucks pay in the mill yard, where the hauls in some instances are not over 300 feet long, and there are 16 stops in a round trip. Little specially designed bin-like trucks with ball bearing castors are loaded with bolts of cloth, yarn, etc., and run on to the big trucks, thus saving time and reducing labor costs. We overcame the long haul problem by installing larger batteries or placing relay batteries at the out-of-town end of the run.

In Australia, South Africa, Brazil, the Philippines, etc., G. V. Electrics are re-making transportation history. Every problem we solve helps us with *your* problem. Ask us for data on our vehicles in your line of business. Remember we manufacture six models (1,000 to 10,000 pounds) and have been making commercial vehicles exclusively for 14 years.

Write for our catalogue.

General Vehicle Company, Inc.
Long Island City, N.Y.
New York, Chicago, Boston, Philadelphia

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2514

The *Edison Monthly* gives an interesting account of its history and operation:

"The early history of 217 is well known. The engine, originally a horse-drawn steamer of the largest size, was converted to the motor type by the removal of its forward running gear and the substitution of two Couple-Gear Freight wheels, a storage battery and the necessary steering and controlling devices. This conversion cost $4,000, and it gave to the city an engine that would have cost not less than ten thousand dollars had new apparatus been purchased; in other words, a dependable steam pumping engine was continued in service with added speed and greater radius of operation.

"With the exception of battery renewals and replacement of minor parts, it stands today just as it did when it went in service on April 24, 1912. The bills for repairs and renewals during the two years have come to just $744.-29, $486.97 of which was for battery renewals that were made after the machine had been in service a year and a half. The balance includes minor parts, labor and decorating, for the engine has taken part in two street parades. Adding depreciation and the cost of charging, operation of this engine has cost the city just $1,370.03.

"The cost of motive power for this same type of engine, but with horses instead of a storage battery, is $1,469.-06 for two years. These figures are based on the records of two companies which ordinarily respond to about the same number of calls as 217. The sum includes depreciation on horses and harness and stable equipment, which at 10 per cent is $105.98 a year. Feed, shoes, and veterinary service for three horses cost $516.86, while the repairs vary. As a rule, better service costs more money. In this case the fire department not only has a better piece of apparatus, but one on which it is saving money. The economy claim is supported by the records of the department—the claim of superiority is based on the actual performance of the engine. In the case of fire fighting this is rated principally by the speed in getting to the blaze. To begin with, the engine saves time in getting out of the house, for there are no horses to harness (incidentally the passing of the horse has done away with the stalls, and the space thus saved is utilized for garaging the car of one of the department chaplains). With no time lost in harnessing and with greater speed through the streets and a wider range of operation, No. 217 is often the first engine at hydrants to which in the days of the horse it was due third."

The experience of Philadelphia with electric fire apparatus has been most successful. Two years ago the first step was taken and Engine No. 20, a first-class steam fire engine weighing 10,500 pounds, horse-drawn, was equipped with an attached two-wheel storage battery tractor. The excellent performance of Engine No. 20 during the tests made in the congested traffic zone induced the Bureau to convert two smaller class steam fire-engines, horse-drawn, to battery tractors, also the two horse-drawn, high pressure hose wagons to storage battery apparatus. In addition to these five pieces of electric apparatus the city of Philadelphia has recently ordered two combination hose and chemical wagons, and one 65-foot aerial truck to be storage-battery driven. This reorder should be especially gratifying to the manufacturer as showing that the electric has proved satisfactory under high speed conditions. In a report on electric fire apparatus given by Chief Mechanician George S. Walker, before the Electric Vehicle Association convention last year, some very interesting tests were described in which the electric excelled all the specifications demanded. In one performance of a fire engine equipped with electric tractor, a distance of four miles was made in 11 minutes, while the same distance consumed 30 minutes with horse-drawn apparatus. Chief Walker says of this performance:

"This test was made to corroborate our belief in the battery tractor, and any person conversant with the territory traversed is well aware that it is no easy going. Along that route there are many hills and one extremely sharp dangerous curve, and the time made on that run, 11 minutes, stands today as record time not excelled by any fire apparatus of any make, weighing very nearly six tons, over the same route * * * The facts presented to me after over a year's experience are so satisfactory and the results so gratifying that I unhesitatingly say that for use in the congested traffic zone and the close adjacent territory thereto, of any large city similarly situated as is Philadelphia, the storage battery tractor is the very best method of propulsion for fire apparatus that is presented by any present-day methods, and I sincerely wish that the Bureau will be able in the near future, to receive the necessary funds, that the present small number of motor apparatus may be so augmented that our city will possess the requisite number of apparatus that modern methods demand of the Department of Public Safety."

No more convincing proof of the superiority of the electric fire apparatus could be obtained than a letter from Chief Engineer W. B. Daggett, of Springfield, Mass., in which he states that the actual use in the service of the department has shown one of the chief advantages of battery-driven apparatus to be absolute positiveness in starting.

"The pieces we have here," he states, "have never failed to start instantly and our experience with them has been such as to inspire a feeling of confidence that they are sure to start when needed, at any time or place.

"We have as good gas-cars as are owned by any city, but there are times when the crank is used more than once to start the engine, and as the larger the engine the more time it takes, also the greater the difficulty to spin. Up to the present time we have not thought of failure in starting with our battery-driven apparatus and no piece has been out of service a minute since they were installed.

"The battery in the aerial truck is two years old. It is my belief that making due allowance for the operation of the batteries under adverse conditions, the cost of maintenance of a piece of apparatus is as follows:

"Renewal of plates (in four years)	$500.00
Renewal of apparatus (in two years), 80 cells at 35c	28.00
Charging batteries (in four years, at $60 per year)	240.00
Broken jars (four years, at $7 per year)	28.00
Total in four years	$796.00
Total in one year	199.00

"In other words I estimate $200 per year as the cost of maintenance of a battery-driven aerial ladder truck of such size and capacity as was formerly drawn to fires by three horses."

When it is considered that the maintenance and upkeep of three horses varies from $500 to $600 per year, it is evident why Chief Daggett is so enthusiastic in his report of the electric apparatus.

In Baltimore, Md., Engine No. 32, of the Fire Department, is equipped with a storage battery tractor, "which," says Fire Chief Enrich, "is the most reliable and economical apparatus in the whole department, and can always be depended upon."

The city of Akron owns a 65-foot aerial truck equipped with electric tractor which, at a demonstration of speed and climbing grades, went up a 13 per cent grade when carrying a full complement of men and equipment and attached to the truck, at the rate of 11 miles per hour, and on level streets the tractor propelled the truck at the rate of 26 miles per hour without any trouble or showing in the least any loss of power.

"In my judgment," said Chief Mertz,

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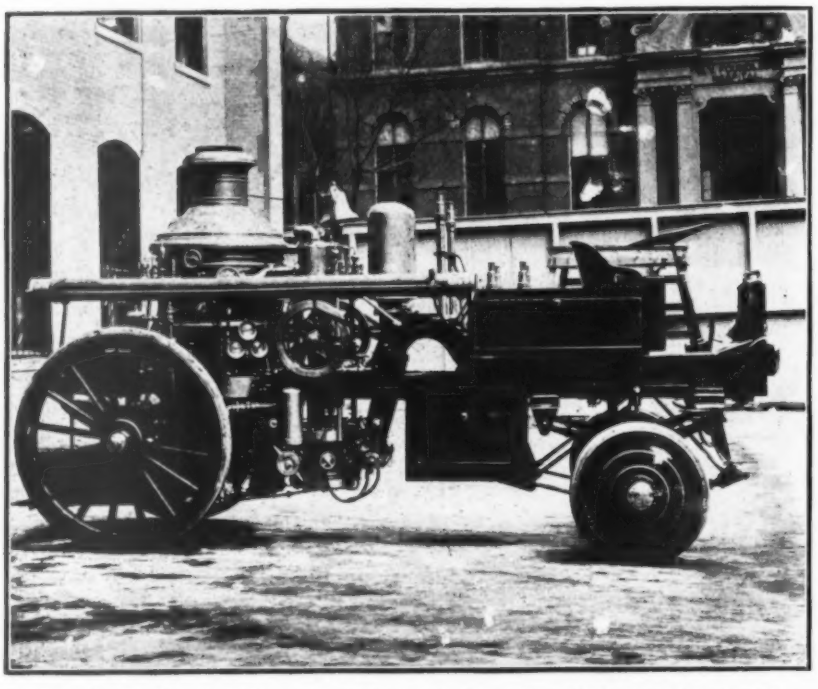
"the storage battery has solved the problem of converting horse-drawn steam fire engines and hook and ladder trucks of any fire department to self-propelled apparatus from a practical standpoint."

As in other departments where the horse is being superseded by self-propelled vehicles, it will not be long before every fire department of any size will be entirely motorized.

It is now a question which will prove the more efficient means of propulsion, petrol or the storage battery. It is an established fact that the electric vehicle is more economical to run than a gasoline car. Without a doubt the gasoline vehicle has its own sphere and as Chief Avery, of Worcester, Mass., states, its use in suburban districts will not be superseded, but for the exacting work in the congested and business



Electrically Propelled Steam Fire Engine Used by New York Fire Department.

centers, "the electric vehicle," he states, "will be the future machine for fire-fighting."

The economy of operating an electric is due largely to its few working parts. As against the gasoline motor and transmission and the large number of working parts, a number of which are reciprocating in their action, the electric is driven by one, two or four motors, as the case may be, and the movement is a revolving one, the least wearing of all movements. In addition, these motors are revolved by electric magnetism and not by destructive explosive forces. The electric car has less than one-half the total parts required with a gasoline car. The life of the storage battery in this class of service is estimated at upwards of five years with one renewal. This estimate is given by Chief Daggett, of Springfield, who has had a considerable experience with electric fire apparatus.

As for reliability, many of the above statements of various fire chiefs bear witness to the absolute dependability of the electric. Its ease of operation and promptness of action arouse utter confidence in it. "The battery tractor has the advantage of the gasoline apparatus," states Chief Walker, "in answering alarms, due to the fact that it is simply necessary for the driver to get on the seat, throw on his controller, and it is under headway in less time than is taken to crank the motor. It eliminates the characteristic ignition and carbureter troubles in starting the motor in cold weather, and the attendant radiator troubles of freezing and leaking."

Another characteristic of the electric fire apparatus, which should commend itself to the heads of fire departments, is its absolute cleanliness. The electric does away with the offensive odors of horses, and the customary litter, dirt and flies, allows more room in the station, eliminates all odors of gasoline and oil, reduces the element of fire, which is characteristic of gasoline equipment. As there is comparatively no grease it is much easier to keep the apparatus clean and of good appearance, all of which adds very greatly to the sanitation of the station.

Although fire apparatus usually has the right of way, there are times when it has to be held up on account of congested traffic, or for other reasons. At such times as these the simplicity of the electric becomes all the more apparent.

Plans Developed for the Coming Convention of Electric Vehicle Association in Cleveland.

Cleveland will be the scene of the Sixth Annual Convention of the Electric Vehicle Association, the convention being held on Monday and Tuesday, October 18 and 19, at the Hotel Statler, and there are excellent reasons for believing that this convention will mark an epoch in the electric-vehicle industry.

The organization meeting of the convention was held in the office of Samuel Scovil, president of the Cleveland Electric Illuminating Company, in Cleveland, on July 19. John F. Gilchrist, president of the Association, addressed the meeting on the general purposes of the coming convention. T. P. Cagwin, of the Chamber of Commerce, accepted the chairmanship of the publicity committee.

After a very extensive discussion, it was decided to limit the convention to two days, namely Monday and Tuesday, October 18 and 19. It is realized that a large number of societies impose heavy demands on concerns and individuals, and that a concentrated program of two days would be greatly appreciated by the large number of delegates who would like to attend the convention. Furthermore, it was decided to make the convention a real business undertaking so that the many companies would feel justified in despatching a large number of delegates. While entertainment will not be entirely dispensed with, yet it will only be employed to supplement the more serious and practical work of the convention, and it is confidently expected that this policy will find the hearty appreciation of the entire industry, and will go far to make the sixth annual convention a bright spot in the Association's history.

The Convention Papers Committee, of which George H. Jones, of the Commonwealth Edison Company, of Chicago, is chairman, held a meeting in the general office of the Association, 29 West 39th Street, New York City, on July 21. As a result of a well attended meeting the committee was enabled to draft a tentative papers program, which includes treatments of subjects of the utmost importance to the industry. In fact, a number of papers scheduled for presentation unquestionably will be the subject of very wide publicity as they will have a marked bearing on the new successful era awaiting the electric-vehicle industry. As soon as the papers tentatively agreed upon are finally approved and acceptances are received from those invited to prepare them, same will be published.